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PUBLIC DOCUMENTS

OF THE

STATE OF CONNECTICUT

VOL. IV — PART 2

1920

PRINTED AND BOUND IN COMPLIANCE WITH STATUTE

HARTFORD
1921

NOTE.

Commencing with the documents for the year 1900, a Document Number was assigned to each State departmental report.

This number was determined by the chronological order of the first printed independent issue of such report and will in future be retained by it, thus showing the relative chronological place it occupies in the printed reports of the State.

A list of these reports, with the date of first printed issue and the document number of each, appears on the following page.

CHRONOLOGICAL ORDER OF FIRST PRINTED REPORTS OF DEPARTMENTS.

Document Number.		
1.	Comptroller	1807
2.	School Fund (since 1909 in Treasurer's report)	1809
3.	Governor's Message	1817
4.	State Prison	1828
5.	Bank Commissioner	1838
6.	Adjutant-General	1838
7.	Quartermaster-General	1839
8.	Board of Education (first issued by Commissioner of Common Schools)	1839
9.	Vital Statistics (first issued by Secretary of State)	1847
10.	Treasurer	1852
11.	Connecticut School for Boys (Reform School)	1853
13.	State Librarian	1855
14.	County Commissioners,	1862
16.	Manual and Roll (since 1907 in Register and Manual and Pocket Manual only)	1864
17.	Insurance Commissioner	1866
18.	State Board of Agriculture	1866
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22.	Indebtedness, rate of tax, etc. (Quadrennial)	1874
23.	Bureau of Labor Statistics	1874
24.	Connecticut Agricultural Experiment Station	1878
25.	State Board of Health	1879
26.	Statement of Vote for State Officers	1880
27.	Criminal Business of the Courts	1880
28.	State Board of Charities	1882
29.	Connecticut (formerly Storrs) Agricultural College	1882
30.	Shell-Fish Commissioners	1882
32.	Dairy and Food Commissioner	1887
33.	Factory Inspector	1887
34.	Storrs Agricultural Experiment Station	1889
35.	Board of Education of the Blind	1895
36.	Highway Commissioner	1897
38.	Commissioner on Domestic Animals	1898
40.	Attorney-General	1900
41.	Examiner of Public Records (formerly Commissioner of Public Records	1900
42.	Dental Commission	1901
43.	Israel Putnam Memorial Camp Ground Commission	1902
44.	Connecticut Prison Association *de* Probation Law	1904
45.	State Police Department	1904
46.	Mediation and Arbitration, Board of	1901
47.	Geological and Natural History Survey	1903
48.	Tax Commissioner	1903
49.	Soldiers' Hospital Board (last report 1908)	1905
50.	Board of Control	1906
51.	Norwich State Hospital for the Insane	1906
52.	Quadrennial Statement of Property exempt from Taxation	1910
53.	Tuberculosis Commission	1910
54.	Connecticut Reformatory	1910
56.	Public Utilities Commission	1911
57.	Rivers, Harbors, and Bridges Commission	1912
58.	Workmen's Compensation Commission	1914
59.	Civil Service Commission	1914
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61.	Public Library Committee (formerly with Board of Education) 1915-1916-1917-1918	1914
62.	Agricultural Extension Service	1916
63.	State Board of Finance (not bound)	1916
64.	Commissioner of Motor Vehicles	1918
65.	Mansfield State Training School and Hospital	1918
66.	Commission on Uniform Legislation	1918
67.	Connecticut Farm for Women	1918
68.	State Agencies, etc. (in Treasurer's Report No. 10)	1920
	Special Industrial Investigation	
	Child Welfare Commission	

LIBRARY NOTE.

In order that each department report of the State of Connecticut for a series of years may be quickly located in the bound volumes of Public Documents, the Comptroller has also given each report a Binding Number by which its position in the bound volumes is permanently established, thus enabling each report to be found in the same position and volume from year to year.

That these several reports may be placed in the libraries of our several exchanges as soon as convenient after publication, he has provided that the State Librarian shall be supplied with two hundred sets bound in volumes of convenient size, each volume to be bound and labeled in harmony with the regular set and sent out as soon as possible after the printing of the reports belonging therein. This arrangement began with the reports for 1902.

Geo. S. Godard.

State Librarian.

Connecticut State Library,
December 31, 1920.

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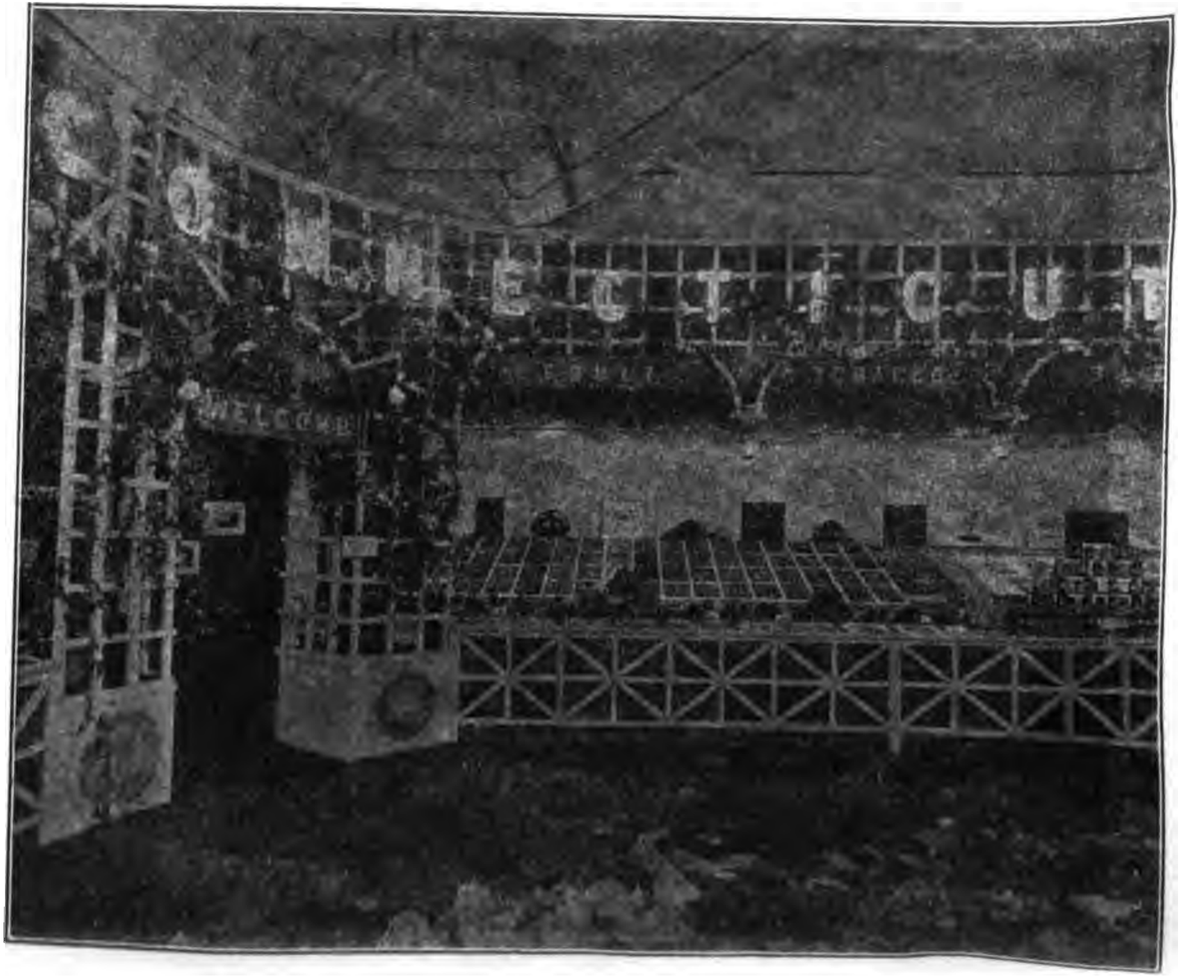


Connecticut Exhibit at Eastern States Exposition, 1920

State of Connecticut

PUBLIC DOCUMENT No. 18

FIFTY-FIRST ANNUAL REPORT

OF THE

SECRETARY

OF THE

Connecticut
State Board of Agriculture

June 30, 1920

Printed in Compliance with Statute

HARTFORD:
Published by the State
1920

STATE OF CONNECTICUT
BOARD OF AGRICULTURE
ROOM 62, CAPITOL.

TO HIS EXCELLENCY,
MARCUS H. HOLCOMB,
Governor of Connecticut.

Sir:—

In accordance with the provisions of the statute I have the honor, as Secretary of the State Board of Agriculture, to submit herewith the Report of the Board for the period beginning October 1st, 1918, and ending June 30th, 1920.

Very respectfully yours,

LEONARD HOLMES HEALEY,
Secretary.

Hartford, July 1, 1920.

State of Connecticut
BOARD OF AGRICULTURE

ORGANIZED 1866. RE-ORGANIZED 1907.

1919-1920

His Excellency, MARCUS H. HOLCOMB, ex-officio.

MEMBERS APPOINTED BY THE GOVERNOR AND SENATE.

		Term expires
C. E. Beach,	West Hartford,	July 1, 1921
W. A. Spaulding,	Norfolk,	January, 1921
Wilson H. Lee,	Orange,	July 1, 1921
Philo T. Platt,	Newtown	January, 1921
Henry H. Lyman,	Middlefield,	July 1, 1923

MEMBERS APPOINTED BY THE GENERAL ASSEMBLY.

Hartford County,	N. Howard Brewer, Hockanum,	January, 1921
New Haven County,	Charles R. Treat, Orange,	July 1, 1921
New London County,	James B. Palmer, Norwich,	July 1, 1921
Fairfield County,	F. E. Blakeman, Oronoque,	July 1, 1921
Windham County,	Everett E. Brown, Pomfret Center,	July 1, 1923
Litchfield County,	H. P. Deming, Winsted,	July 1, 1923
Middlesex County,	F. S. Chapman, Old Saybrook,	July 1, 1923
Tolland County,	Charles A. Thompson, Melrose,	July 1, 1923

OFFICERS OF THE BOARD.

Governor Marcus H. Holcomb, *President ex-officio.*

Wilson H. Lee,	Orange,	*Vice President*
Charles A Thompson,	Melrose,	*Treasurer*
Dr. E. H. Jenkins,	New Haven	*Chemist*
Dr. G. P. Clinton,	New Haven,	*Botanist*
Dr. W. E. Britton,	New Haven,	*Entomologist*
N. S. Platt,	New Haven,	*Pomologist*
Leonard H. Healey,	North Woodstock,	*Secretary*
Hallie G. Root,	West Hartford,	*Ass't Secretary*

EXECUTIVE COMMITTEE AND AUDITORS.

N. H. Brewer. C. R. Treat. J. B. Palmer.

Charles R. Treat, Orange, Connecticut.
TRUSTEE CONNECTICUT EXPERIMENT STATION.

Everett E. Brown, Pomfret Center, Connecticut.
TRUSTEE CONNECTICUT AGRICULTURAL COLLEGE.

CONNECTICUT
STATE BOARD OF AGRICULTURE.

The Connecticut Board of Agriculture was established by act of Legislature, holden in New Haven on the first day of May, 1866. Said act provided that the Board should consist of the Governor, one person appointed from each county by the incorporated agricultural societies in each county receiving an annual bounty from the State, and four other persons appointed by the Governor, with the advice and consent of the Senate.

This Board was empowered to receive and hold donations or bequests for promoting agricultural education and the general interests of husbandry; to prescribe forms for and regulate the returns required from agricultural societies.

The Secretary was required by statute to visit different sections of the State annually, for the purpose of inquiring into the methods and wants of practical husbandry, ascertaining the adaptation of agricultural products to soil, climate, and markets, encouraging the establishment of agricultural libraries and reading rooms, and disseminating agricultural information by lectures or otherwise.

For the purpose of preventing the spread of contagious diseases among domestic animals, the Board could prohibit the introduction of any such animals into the State, and could quarantine any infected animal in the State. The Board could also appoint three commissioners on diseases of domestic animals, having all of the powers of the Board in regard thereto.

By act of the General Assembly of 1897, the Board was reorganized to consist of one member from each county of the State, elected by the Senators and Representatives of said counties respectively, and the power to investigate the contagious diseases of domestic animals was given to one commissioner, appointed by the Governor, with the advice and consent of the Senate.

The Legislature of 1899 amended this act by providing for the appointment of one member from each congressional district by the Governor, making the Board to consist of twelve members as formerly, with the Governor as president, *ex-officio.*

The Legislature of 1918, again amended this act to comply with the redistricting of the State, providing for an appointment by the Governor of one member from each of the five congressional districts, so that the Board now consists of thirteen members, with the Governor as president, *ex-officio.*

The statute, in part, reads as follows: "The State Board of Agriculture shall consist of the governor, who shall be *ex-officio* president of the board, and thirteen other persons. During the first month of the session of the general assembly in 1919, and quadrennially thereafter, the governor shall appoint one member of said board from the second congressional district, one member from the fourth congressional district and one member from the fifth congressional district, and during the first month of the session of 1921, and quadrennially thereafter, he shall appoint one member from the first congressional district and one from the third congressional district. Such appointments shall be made with the consent of the senate. During the first month of the session of the general assemby in 1919, and quadrennially thereafter, the senators and representatives of each of the counties of Windham, Litchfield, Middlesex and Tolland shall elect for each of said counties a resident of such county to be a member of said board, and during the first month of the session of 1921, and quadrennially thereafter, the senators and representatives of each of the counties of Hartford, New Haven, New London and Fairfield shall elect for each of said counties a resident of such county to be a member of said board. Each of said members shall hold office for four year from the first of July succeeding such appointment or election. Vacancies that occur when the general assembly is not in session may be filled by appointment by the governor until the Wednesday of the third week of the session of the next general assembly, and vacancies so filled, or occurring during a session of the general assembly, may be filled for the unexpired portions of terms as herein provided for elections or appointments for full terms."

Section 2072 of the General Statutes reads in part as follows: "The board shall, during the month of September in each year, appoint a secretary, a treasurer and such other officers as the board shall determine who shall hold office for the term of one year from the first day of October next succeeding their appointment and until their successors are appointed and qualified. The treasurer shall give a bond of four thousand dollars for the faithful discharge of his duties. The board shall have its office in the state capitol."

Hon. Theodore S. Gold of West Cornwall was elected the first secretary in 1866, and was re-elected each year until July 1, 1901, when he was succeeded by Col. James F. Brown of Stonington. Colonel Brown held the office until July 1, 1909, when he was succeeded by I. C. Fanton of Westport, who held the office until July 1, 1911, when the board elected Leonard H. Healey of North Woodstock, the present secretary.

Capitol, Hartford, June 25th, 1919.

A meeting of the State Board of Agriculture was held at the office of the Secretary of the Board on June 25th. Full membership present. Mr. F. S. Chapman of Old Saybrook, a newly appointed member for Middlesex County being in attendance.

The Secretary gave a report of his visit to Bridgeport at the request of the New York State Department of Agriculture to investigate sales which had been made to commission merchants there. As a delegate to the National Milk and Dairy Farm Exposition in New York, the Secretary made a report. Mr. F. E. Blakeman who was also a delegate supplemented the report. Mr. Blakeman stated that it did not equal in his estimation the exhibit which was put on by the Farmers' Week Committee in Hartford.

The question of making a state exhibit at Springfield was discussed. The Board by unanimous vote decided to make an exhibit. A committee was appointed to make all arrangements.

The Secretary was directed to take a census in order to learn the condition of the fruit outlook of the state; this in cooperation with the State Pomological Society.

A Committee was appointed to select the delegates to the fall fairs.

The Secretary was directed to compile a bulletin containing the agricultural laws of the state and that there be published besides the report one thousand copies for outside distribution.

The Secretary was directed to take up with the authorities at Washington the question of a soil survey for the six remaining counties of the state; New London and Windham Counties already having been surveyed.

The Board placed themselves on record as in favor of the repeal of the "Daylight Saving Law."

The Treasurer's report was presented and referred to the Executive Committee for approval.

The members of the Board made a visit to the farm home of Mr. C. F. Sturhahn who was scored 92 points by the inspectors in the Dairy Commissioner's Department for his dairy and dairy equipment. Mr. Sturhahn's dairy buildings and everything connected therewith are up-to-date and sanitary in every particular. Anyone interested in a modern dairy should visit Mr. Sturhahn's farm.

The La Salette Corporation Farm at Bloomfield was next visited. This farm had received the highest score of any visited by the inspectors of the Connecticut Dairy and Food Commission; namely 95 points.

The Secretary stated that the inspection of the several dairy farms had just been completed by those in the employ of the Dairy and Food Commission and the Commissioner stated that their records showed that there were 100,000 dairy cows in the state; dairies averaging ten cows each.

August 6th, 1919.

In accordance with invitation given by the Connecticut Agricultural College, a meeting of the Board was held in the reception room of the president of the College on the above mentioned date. The day was very stormy and only six members of the board were present.

A communication was read from the county agricultural agent from New Haven County, asking for the co-operation of the Board in editing a state publication to be issued monthly in co-operation with the Extension Department of the College, which would contain information of articles and animals for sale, statewise. The Board voted to approve of this request and solicit the co-operation of the Extension Department. The Secretary was directed to confer with either Mr. Baker or Mr. I. G. Davis in regard to it.

The appointment of delegates to visit the several fairs in the state was next considered. It was left for the Executive Committee to complete the work.

After luncheon in the office of the president the members adjourned to the Armory to listen to an address by Mr. Kenyon L. Butterfield of the Massachusetts Agricultural College. It was a very able address, bringing a great deal of information in regard to agricultural conditions as he had found them in France.

September 29th, 1919.

The annual meeting of the State Board of Agriculture in accordance with notice was held at the Garde Hotel. All members were present. Tellers were appointed and ballot ordered with the following result: Mr. Wilson H. Lee was chosen vice-president, Mr. Charles A. Thompson, Treasurer, Mr. N. H. Brewer, Mr. Charles R. Treat and Mr. J. B. Palmer as Executive Committee. Mr. E. E. Brown was elected a trustee of the Connecticut Agricultural College for one year and L. H. Healey, Secretary.

Mr. F. E. Blakeman presented the subject of marketing reports which were being sent out by the cities of Bridgeport, New Haven, Waterbury, Hartford and Norwich, and thought they were a great help to the farmers and to the city people as well. Both were kept posted in regard to market prices on farm products. Information was given that these reports were to be discontinued. The Board by vote requested the Secretary to take the question up with the president of the College and ask that they be continued.

The Mondell Bill now before Congress was brought to the attention of the members. A lengthy and interesting discussion took place in regard to this provision and the help which it contemplated for returned soldiers by placing them upon farm lands through the establishment of model villages. The sentiment of the Board was unanimously in favor of such amendments to the bill as would mean the placing of the returned soldiers upon farms already in a productive condition, these farm lands being vacated at the present time because of the labor situation.

A large number of bills incurred in connection with the state exhibit at Springfield were presented and received the endorsement of the Auditing Committee, and were turned over to the Treasurer with directions to pay the same.

Delegates appointed to the several fairs were as follows:

Chester Agricultural & Mechanical—Chapman.
Conn. State Agri. Society—Palmer, Brown; Lyman, Lee; Beach, Deming.
Coventry Grange Fair Assn.—Kimberly.
Durham Agri. Fair Assn.—Neilson.
Goshen Agri. Society—Blakeman.
Granby Agri. Fair Assn.—Thompson.
Guilford Agri. Society—Brewer.
Haddam Neck Grange Agri. Assn.—Chapman.
Harwinton Agri. Society—Beach.
Lyme Grange Fair Assn.—Chapman.
Madison Agri. Fair Assn.—Blakeman.
Mansfield Fair Assn.—Neilson.
Middlebury Fair Assn.—Lee.
New London County Agri. Society—Healey, Brown; Treat, Brewer.
Norfolk Agri. Society—Deming.
North Canaan Agri. Fair Assn.—Kimberly.
North Stonington Grange Fair—Palmer.
Rockville Fair Assn.—Treat, Brewer; Neilson, Chapman.
Stafford Springs Agri. Society—Lyman, Thompson; Brown, Healey.
Union Agri. Society—(Riverton) Blakeman.
Union Agri. Society—(Ellington) Healey.
Washington Fair Corp.—Beach.
Windham County Agri. Society—Healey.
Windsor Agri. Society—Deming.
Wolcott Agri. Society—Lee.
Woodstock Agri. Society—Palmer, Treat.
Connecticut Fair Assn.—Thompson, Lyman; Kimberly; Deming, Brewer.

January 1st, 1920.

Meeting of the State Board of Agriculture held at the office of the Secretary. Eight members were present. The Vice-president being absent, Mr. F. S. Chapman was chosen chairman.

Reports of the delegates at the several fairs were read. Those making the reports regretted in many instances the non-cooperation of fair officials in their efforts to eliminate gambling at agricultural fair exhibitions. The members of the Board regretted this and thought that more strenuous forms of control must be adopted in the future.

A communication was read from the Secretary of the Kansas State Board of Agriculture relative to the taxation of farm property. The members felt that the value of farm property in many towns was being increased beyond reason in comparison with the property owned by village residents.

Mr. C. R. Treat, Chairman of the Committee explained to the members the action which had been taken in regard to the continuance of the state's market reports published by the Extension Department. The Committee had appeared before the Board of Control and at the request of the Committee the Board of Control had made an appropriation sufficient for the continuance of the service until July 1st, 1920.

The Secretary called the attention of the members to the publication of "Connecticut Agriculture."

April 8th, 1920.

A meeting of the Board was held at the office of the Secretary. Ten members were present. Secretary made a statement in regard to a verbal ruling which had been received from the Attorney-General. This was in reply to a communication submitted to him asking a statement as to what authority the Board had in enforcing certain rules and regulations made by them for the holding of agricultural fair exhibitions, especially controlling gambling. A vote was taken advising the Secretary to withhold his approval for the state appropriation due to certain agricultural fair associations because of conditions existing on their grounds at the time of holding their agricultural fair exhibitions.

A statement was made by the Secretary describing the action which had been taken by him and the efforts which he had made to oppose the daylight saving plan. The Board unanimously approved of the work done by the Secretary. The Secretary was directed to wire Governor Coolidge asking him to veto the daylight saving plan as passed by the Massachusetts House and Senate.

A verbal report was made by the members present in regard to the damage which had been done by field mice to fruit trees in Connecticut. It was stated that $20,000 worth of damage had been done in Middlesex County. One fruit grower made a statement that his orchard had been damaged to the amount of $1,000. The consensus of opinion was that between $25,000 and $50,000 worth of damage had been done throughout the state to small fruit trees by the ravages of mice.

A communication was read from Professor H. J. Baker in regard to the Connecticut Dairy Food Council and the formation of the same.

A communication was read from Mr. J. C. Simpson, Manager of the Eastern States Exposition, and the Board voted that it was in favor of making an exhibit for the Eastern States Exposition for the fall season of 1920.

The Board voted to renew its activities in the corn and other club work.

A very interesting report was made by Mr. Charles R. Treat for the Committee attending the hearing at Washington before the Federal Horticultural Board in regard to a proposed quarantine affecting the New England States forbidding the shipment of seed corn. Mr. Treat explained that quite a number of people from Connecticut were at the meeting. The result of the meeting and the final action of the Committee was very satisfactory. Notice had already been received from Washington through the Federal Horticultural Board that the general federal quarantine had been placed upon all New England States except Connecticut, and yet shipment would be permitted from any portions in any of the states except areas infested with the corn borer. The Committee and the members of the Board felt very grateful that Connecticut was not included in the quarantine and thought it was a just ruling as there was nothing in the shape of evidence that there were any corn borers in Connecticut, as none had yet been discovered. Statement was made that nearly a million dollars worth of sweet corn on the cob was shipped out of the state; also several carloads of field corn.

Mr. F. E. Blakeman gave a very interesting report on his trip to New York where he represented the Secretary of the Board who had been invited to a conference of all the Commissioners of Agriculture of the several states. The Secretary was unable to attend. The conference was in regard to marketing conditions. The result of Mr. Blakeman's most excellent report was a vote taken by the members that it was the unanimous opinion that a Bureau of Markets similar to Bureaus in other states should be established in the State of Connecticut under the State Board of Agriculture. Mr. Blakeman stated that there were thirty-six states that already had Bureaus of Markets. The following resolution was unanimously adopted:

WHEREAS, the country can have more only by producing more and increased production can result only from the common effort of the farmer, the laborer and the capitalist, and

WHEREAS, the farmer is today marketing at a minimum profit and sometimes at a loss more raw materials per man by thirty percent than before the war, due largely to long hours and the unpaid labor of his wife and children; and this unpaid labor and overwork being materially responsible for so many leaving the farm, and

WHEREAS, all should recognize that agriculture is basic and fundamental and a declining agriculture will result in a declining nation and a declining civilization and that the people of America must have concern for the future of agriculture, and

WHEREAS, the farmers comprising the largest single business element of the nation demand that in the settlement of the present day industrial controversies the interests of agriculture shall be considered and safeguarded for the good of all, and

WHEREAS, the farmer does not demand sixty per cent advance and less hours or the excessive profits accredited to capital and he will meet every responsible condition of readjustment relations but should not be subjected to the hazardous undertaking of the increased production with constant and radical fluctuation of daily markets, and

WHEREAS, on the prosperity of agriculture depends the progress of every other line of effort, THEREFORE BE IT RESOLVED: That we demand that both capital and labor meet the farmer in increasing production, insisting that the country's output of finished products be not restricted by shorter hours and exorbitant charges for labor or by excessive profits for capital, and we further demand that distribution be not hampered by costly and inefficient methods and that the interests of the farmer be safeguarded by having a bona fide farmer upon all official boards, whether national or state whose duties have to do with questions affecting agriculture.

The Secretary was directed to arrange with Honorable Samuel Russell, Jr., for a visit to his home farm to see his herd of Hereford cattle. The Board was instrumental in getting Hereford cattle into the state during the war and is therefore especially interested in Mr. Russell's herd.

May 12th, 1920.

The meeting of the Board of Agriculture was held at the Arrigoni Hotel at Middletown. Ten members were in attendance. Mr. Lee being absent, Mr. F. S. Chapman was chosen chairman.

A communication was read from Mr. A. J. Brundage relative to club work in the state and Mr. F. S. Chapman was appointed as a committee of one to act with the Secretary with power to take such action as they deemed best relative to the club activities of the Board for the year 1920.

A resolution was received from the Connecticut State Dairymen's Association asking the State Board of Agriculture to use its best endeavor, taking legal action if necessary to enjoin the Mayors of Connecticut cities from enforcing the so-called daylight saving ordinance. While the Board was in full sympathy with the resolution and realized the detriment that the so-called daylight saving was to the farmers they did not deem it best to take any action in regard to it.

A communication was received from the farmers en route between Willimantic and East Thompson asking that the Board interest themselves in the train schedule as made under the daylight saving plan, stating that many of them have to get up at 2:30 in the morning in order to get the milk to the station. The train leaves Hartford at 3:40 instead of 5:00 as formerly. The Board directed the Secretary to take such action as he deemed advisable in regard to this communication. The Secretary reported that the following telegram had been sent to Governor Coolidge:

"Governor Coolidge,
State House.

At a largely attended meeting of the Connecticut State Board of Agriculture I was directed to wire you stating that our members by vote (unanimously) hope that you may see your way clear to veto the Daylight Saving Bill now before you for action. We are doing this because the management of the New York, New Haven & Hartford Railroad have stated that they would not change their schedule of trains unless the Daylight Saving became a law in your state, therefore the signing of the Bill will not only make it a law for your state but (in effect) for Connecticut as well. A great number of our farmers are already discouraged and the result is seen in the farm property offered for sale, 106 such advertisements appearing in one issue of the "Hartford Daily Courant." Numerous auctions are being held and many herds of dairy cattle are being sold.

Farmers can get only 50% of the necessary farm hands, and these only at almost prohibitive prices. Daylight Saving means increased cost of all farm grown products by at least 20% and a decrease in production of from 20 to 25%. Must the city people realize the situation too late for their own good? Is higher cost of all farm products and a decreased production offset by the increased pleasure of those who live in the cities and our large villages?

Very respectfully,
L. H. HEALEY,
Secretary of the State Board of Agriculture."

A communication was read from Mr. Kerrill K. Kimberly notifying the members of the death of his brother Karmi Kimberly. The Board adopted a resolution of sympathy for Mrs. Kimberly, the resolution also containing words of appreciation and regret at Mr. Kimberly's death.

The Board expressed itself as opposed to a milk bill now pending before Congress, and voted that the Secretary be instructed to notify Congressman John Q. Tilson of the action taken.

The Board made a visit to the farm home of Honorable Samuel Russell, Jr., inspecting his several farm activities. He has a flock of sheep which were of interest to those engaged in sheep husbandry. His herd of "White Faces" on his "Hill Pastures" was the greater attraction. A close inspection of these sleek looking animals only brought out more clearly their value as economical beef producers. The farm barns of Mr. Russell, his cows, calves, swine and several fine teams of horses would delight any lover of farm stock.

Resolution adopted on the death of Mr. Karmi Kimberly.

We members of the Connecticut State Board of Agriculture desirous of expressing our sorrow at the death of our colleague Karmi Kimberly, and to give evidence of our sympathy with his bereaved family, have ordered at a meeting of the Board held at Middletown, on May 12th, 1920, that the following be entered upon our records and a copy sent to the family of the deceased:

Resolved, that we the members of this Board have received with profound regret the sad news of the death of our fellow member Karmi Kimberly—who died April 10th, 1920. That we shall miss from our meetings one who was constant in attendance, conscientious and diligent in all the appointments which came to him, maintaining always a desire to do his bit to advance the interests of agriculture. We sincerely mourn his decease and extend to his bereaved family our heartfelt sympathy in their great sorrow.

June 24th, 1920.

A meeting of the State Board of Agriculture was held at "Fairlea Farm." Ten members were present. As Mr. Lee was busy entertaining guests, Mr. Charles R. Treat was appointed president, pro tem. A resolution was offered and adopted adjourning the meeting to the first Wednesday in July at 12:00 o'clock standard time.

From these minutes those who are not members of the Board can get some idea of what the Board is doing in order to promote agriculture in our state.

At the present time the office is fully equipped to answer all inquiries and questions that may be asked by those interested in farming and farm conditions throughout the state.

The Secretary cannot resist the temptation to satisfy his own sense of justice and pride by calling the attention of the reader to the fact that the State Board of Agriculture is the only state organization which has for its object the encouragement and promotion of agricultural prosperity, every member of which is a real farmer and operating his own farm. The advancement of our states' agriculture in all of its phases, the production of crops and the marketing of them so that the producers shall receive a cost price plus a percentage of profit, is the goal which the Board has ever had in view.

The sooner those who are consumers only, recognize that agricultural prosperity means general prosperity and are willing to co-operate with the farmers to make agriculture profitable, the more quickly will real prosperity come to our whole country. The activities of the Board in its endeavor to increase Connecticut agricultural prosperity have been greater this year than ever before.

The number of those interested in farming who have written to the Secretary or visited the office to secure information or advice, or who have been aided by the personal assistance of some member of the Board, are more numerous than in any previous year. In seeking assistance or in seeking solution to their many problems connected with farm life they have sought the advice of those who have made a success in the same line of work as that in which they were engaged.

The placing of the high cost of living on the farmer's doorstep by many of our labor agitators and the opening of the door to his domicile and the throwing of the gauntlet at his feet have cemented the farmers together in a determined movement that he shall only be blamed for the disturbance which he creates.

The farmers of Connecticut have been told time and time again that they were not doing their part towards Connecticut's prosperity. Let us see, the value of Connecticut's farm crops exceeded the value per acre of the great farming section of Ohio, Indiana and Illinois. The farmers are told that in

1900 there were 1,064,525 acres of improved farm lands and in 1910 only 988,252 acres. These same critics forget to state that the value of these farm lands in 1910 because of their increased fertility and their ability to produce more per acre were worth nineteen and one-half millions of dollars more than they were in 1900.

Those who tell us that Connecticut agriculture is going backward, forget the increase in the number of bushels of apples, baskets of pears and peaches, and other small fruits during the last few years. They forget to say anything about the increase in the amount of dairy products produced or the increase in the number of sheep and swine which have been made in the last two years. What we do hear is this, the farmers must till more acres and raise more farm products, never mind the cost price or the selling price, but produce them. Sometimes it is well for those who criticize to give a word of encouragement. Why do we not hear them say that in 1918, for instance, the hay product per acre in Connecticut was not exceeded by any other New England state, and that its total value was $12,576,000. We cannot help wondering if they know that the Connecticut farmers grew 2,800,000 bushels of corn in 1918 and its farm value was $4,788,000. We wonder if their attention has been called to the fact that the value of Connecticut's small grains in 1918 was $1,636,000. We wonder if they know that our farmers although badly handicapped by the shortage of labor produced 2,476,000 bushels of potatoes last year. The only thing that we have heard them say is that the price which they had to pay for potatoes was almost prohibitive. They do not seem to realize that although potatoes were very high for the last season, the cost of producing them throughout the state (when the yield which the farmers received is considered) was more than the price they received for them. Are not Connecticut farmers doing their share at least under the present conditions toward Connecticut's prosperity?

The value of Connecticut's wheat, oats, barley, buckwheat, potatoes, hay and tobacco in 1918 was $39,576,000; more than any other New England state except Maine. It is hardly fair to compare Maine with Connecticut, a state with an area of more than 80,000 square miles can hardly be compared with a state with an area of only 5,000 square miles.

Why should the farmers be the only ones to produce more that prices to the consumer may be less? Why should not the manufacturer make more shoes, more suits, more farm machinery and over-stock the market that prices may be lower and thus enable us to buy the necessary tools to assist in the raising of our farm crops? If fertilizer, if plows and harrows, tractors and reapers, mowing machines, hay forks and other implements used on the farm, and many used in the household, cost one-half what they do at the present time it would materially lessen the cost of food products. If the laborer working in our factories had to work the same number of hours per day and receive anything like the per diem wage that the farmer received "the high cost of living" would be cut in two in the center, and all lines of business would be on a more equal footing.

Is the panacea for all our troubles and unrest that the farmers solve the problem by producing cheap food? We believe that the laboring men and women have something to do in solving these problems.

The Secretary of the Board has been very active in opposing the so-called daylight saving law which has added many hardships to the life of the farmer and handicapped the production of food products in many ways. We cannot refrain from adding a word in regard to this at this time. It is the worst thing imaginable from the farmers' viewpoint. It increased the cost of all farm products from 15 to 20%. It has also decreased the amount of production of all farm products from 20 to 25%. If our city friends are really desirous of cheapening the cost of farm products and of increasing the quantity produced, it is up to them to assist the farmers to kill this daylight saving proposition. The number of farm laborers has decreased 25% because of the daylight saving law alone, and many of the farm owners have closed out their dairy herds at auction and quit working their farms and gone into some manufacturing plant where they can get better wages than they were able to obtain through their farm operations and shorter hours, as well. Is it right that the farmers be driven to quit the real business of life which is the production of food because the other part of our people desire more pleasure?

The life of the farmers during the last two years has been a strenuous one at all times, and under all circumstances has he tried to do all possible to meet the food requirements of the country, and these under the greatest of difficulties. It is not news to a great many people to state that the farmers of the country, and this under the greatest of difficulties. It is not have a real list of grievances which are so real and fundamental that they cannot be passed over lightly.

Our western friends have tried to feed $2.00 corn to fourteen cent hogs and make a living thereby. Millions of dollars have been lost in feeding high priced feeds to cattle, and then being obliged to sell them at ruling beef prices. They have watched the consumer as they have paid high prices for their pork chops and beef steaks, while the returns received from their cattle and hogs have grown less.

The labor situation has been serious. All sorts of manufacturing companies have increased the pay of the laborers, thereby bidding for those working upon the farms, while the farmers have strenuously tried to keep the necessary farm workers but could not pay them the prices that they could obtain in the city with many of the enjoyments of life therein which did not come to them in a great many of our farm homes. Beautifully painted pictures of high wages and better living conditions have succeeded in taking away the most able bodied and efficient of our farm laborers. What is true of other states is absolutely true of Connecticut.

It has been impossible to get agricultural machinery, fertilizers, seeds for planting, dairy feeds, etc., even at the almost prohibitive prices that have been asked for them. The reason for this being lack of cars, strikes and other reasons which the farmers have not been able to fathom. Not only have the farmers been hard hit in getting necessary supplies to operate their farms but in many instances even in Connecticut have they been unable to get transportation to dispose of the products which they have raised. While our dairy farmers have been paying from $50.00 to $90.00 a ton for dairy feeds, the elevators in the western section of our country are filled with grain. Cars cannot be secured to move it. Flour is high in price with plenty of wheat in storage. Why should not the farmers be puzzled? Everything they have to sell is comparatively low in price or there is no market. Yet city consumers never paid such high prices.

Everyone is willing to admit that agriculture is the basis of prosperity. If this is true and we all know it is, why should it not receive as much attention and those who are engaged therein get a fair renumeration for the time which they and theirs put into it? Agriculture is the leading industry of our nation and it is by no means a nonentity even in Connecticut. It has received and is receiving a great deal of attention, but much of this attention is in the way of criticisms from those, who, to say the least, are not knowing about the conditions which they endeavor to criticise. Conditions have changed rapidly in recent years and there is now a possibility of shortened production and this not through any fault of the farmer.

The wages demanded by skilled farm help has become in most cases prohibitive and that of our common farm labor is even worse when we consider the number of hours they are willing to work and what they expect to do in the hours in which they labor.

Our farm boys responded to the call of their country and then upon their return lured by high wages and other attractions entered the office or the work shop of the manufacturer. They have not as yet come back. It is this latter fact which is troubling us and which should cause the city resident much worry. A movement from the farm to the city is not wholly the result of the war. It has been in evidence for more than thirty years but the recently increased wages and shorter hours of labor offered by the manufacturer have accelerated the movement.

In 1880 the percentage of population engaged in farming was 44 4/10%, in 1889, 39 2/10%, 1900, 35 7/10%, in 1910, 32%. The figures for 1920 are not yet available but so far as obtained show that the tide is still strongly set from the country towards the city. There are those who are still unconvinced that the farm people are not the ones who are really the most prosperous and are receiving more for the products of their farms than they ought to get.

The best test of the reasonableness of farm prices is the movement from the city to the farm or from the farm to the city. If the farmer should for any length of time make profits which are out of line with the profits made by people who work in the cities, there would begin a steady movement from the city to the farm. For it must be remembered that a large number of people who are working in the cities now were born and brought up on the farm and know how to farm. They know the advantages and the disadvantages of the farm. They know the profits to be made from the farm as compared with the profits they are making in the city. As long as the trend of population is from the farm to the city, it may be set down as a fact that the financial rewards, taking into account living conditions, are greater in the city than on the farm.

The percentages which we have given you show the magnitude of the "farm to the city" movement. To the careful student comes the thought that a continuation of these conditions contain a certain element of real danger to our social structure. We must have tillers of the soil. We cannot put ourselves in the position of being dependent upon other nations. No one wishes to do this. Present day farm life is not unattractive if it can be made profitable. It is the farmer's business to feed and clothe the human family but it must be done at a profit by him or he cannot continue his business. We are looking hopefully toward the future for a betterment of these existing conditions. The farmer cannot solve these conditions alone. He can curtail production but this he does not wish to do. May we not hope that the future will solve these necessary problems? The economic question relating to farm production now confronting us must be met and we believe that when all classes of people realize the seriousness of the situation as it now exists, each will be willing to do his part to bring to pass conditions that will mean prosperity for agriculture and those engaged therein and for all other classes of people as well.

Respectfully submitted,

L. H. HEALEY.

CONNECTICUT FARMERS' WEEK.

Six years ago last fall, President Beach of the Connecticut Agricultural College suggested that all the various State Agricultural Associations combine their mid-winter meetings and hold what was known in the west as "Farmers' Week." It was also contemplated at that time to hold an Agricultural Exhibition in connection with the literary programs as arranged by the several Associations. Sentiment could not be crystallized in favor of such a movement; nothing was done at that time.

A year later the Connecticut State Grange appointed a committee of three to arrange for a state mid-winter agricultural exhibition; this exhibition to be put on in connection with the holding of the State Grange during the month of January. The committee was appointed, quite a little investigation made and several preliminary plans were arranged by the committee; then, it was found that because of the lack of cooperation from the several sub-ordinate Granges the movement would probably be a failure. It was thought best not to have any than to have an exhibit which would not be a credit to the state. So the plan as contemplated by the State Grange was abandoned.

A little more than one year ago when every one in the state was so strenuously engaged in war activities it occurred to some of the leaders that perhaps the Farmers' Week which had been suggested could be made a success.

The first suggestion towards starting the work was made by the agent of the Hartford County Farm Bureau to the Connecticut State Council of Defense. The Connecticut State Council of Defense took it up with the State Board of Agriculture and the Secretary suggested a conference of the President and Secretary of all the various State Agricultural Associations. The State Council of Defense issued a call for such a conference. The various officials representing these several Associations responded. When the meeting was called to order by Mr. George M. Landers there were nearly fifty people in attendance; plenty of enthusiasm was in evidence; a vote was taken to organize for the purpose of holding a "Farmers' Week."

The committees were appointed and each one was assigned certain duties to perform. The result of the preliminary effort and the work of the committees appointed resulted in the holding of the first "Farmers' Week" in the State Armory from January 20th to 24th, 1919. General expressions of approval were voiced by those in attendance. The exhibition especially was looked upon as a success. The holding of the meetings of the several Associations, in places other than in the building where the exhibits were staged, was the greatest drawback. In general, satisfaction with the movement was expressed.

As the time drew near for the annual meeting of the several Associations for 1920 representatives of these Associations were called together and it was voted almost unanimously to hold the second "Farmers' Week" for the winter season of 1919-1920. Committees were appointed and everything began to move forward.

The first obstacle met was in securing the State Armory for holding both meetings and the exhibit. After several consultations with the Military Emergency Board and after the State Manufacturers' Association had been invited to cooperate and a committee had been appointed by them, the permission of the Military Emergency Board was granted for the use of the Armory for the staging of the exhibit and holding of the meetings.

An Executive Committee was appointed to take general charge of all arrangements. The space on the Armory floor was divided into three sections:

One-third being assigned to the Manufacturers' Exhibits.
One-third to Agricultural Exhibits.
One-third to Trade Exhibits.

Had it not been for the inclement weather encountered during the holding of the exhibit everything would have been a great success. All things considered we will have to call it a success although some of the spaces assigned to exhibitors were not taken, on account of their being unable to get their exhibits to the Armory.

The success of the Exhibition depended a great deal upon the young ladies who assisted in the clerical work, both before and during the week of the Exhibit; those in the several departments at the Capitol and the two young ladies from the College. They did not stop to consider hours, but tried their best to do the work assigned them and get it finished at the earliest possible moment.

As near as we could estimate more than 100,000 pieces of mail matter was issued from the main office. The number of exhibitors in the several sections was most gratifying. As a matter of record the files showed there was a total of 168 exhibitors; 75 in the Manufacturers' section; 23 in the Agricultural section and 70 in the Trades' section. These have been classified and arranged alphabetically as well as by sections.

The demand for more space by the concessionaires showed it was popular from their viewpoint.

The spirit with which the Conn. State Manufacturers' Association cooperated was very gratifying. Their representatives having the securing of exhibits, assignment of space, etc. were thoroughly in earnest in making each department a success.

The addition of the New Departure Company's band from Bristol, which was furnished free of charge was very pleasing; the music was most excellent and entertaining. The thanks of the General Committee were extended to these people for their contribution.

Perhaps as a finishing sentence it would not be amiss to sum it all up by saying that while we were not satisfied and ought to look forward to something better in the future, if we consider weather conditions and the many handicaps which it gave us, we should at least be pleased with the week's exhibit. Nothing has ever been done in Connecticut that has advanced the position which Connecticut agriculture should hold in our own state as well as the last Farmers' Week Agricultural and Industrial Exposition has done, and we make the suggestion that the several Associations decide at once as to whether they will hold a 1920-1921 "Farmers' Week" exhibit, and then if such a decision is made take steps immediately to select the date to secure the Armory and make all preliminary arrangements. We believe the result of these early arrangements will be manifested in a better display of agriculture which will be made at the time of the exhibit.

P. S.—Arrangements are now in full swing for a 1921 Agricultural and Industrial Exposition for the first week in January, 1921.

CROP PRODUCTION FROM THE FARMER'S STANDPOINT.

Dr. C. A. Zavitz, Guelph, Ont.

Each year we have a large class of young men from the farms of Ontario who attend a short course in seed and stock judging at the Agricultural College. The question as to the greatest influences which can be accomplished in the improvement of crop production is discussed by each class and after the discussion a verdict is taken as to the opinion of the majority of those present. Up to the present time the decision is in favor of the five following factors of farm crop improvements and in the order here indicated: (1) Better seed; (2) Better cultivation; (3) Better drainage; (4) Better fertility, and (5) Better rotations. When in Nova Scotia three years ago assisting at the short course at the Agricultural College at which two hundred were present in connection with practical work in seed judging, the majority of those present placed "Better seed" as the most important factor in the crop production of that Province. If this matter were discussed at the gathering of farmers present at this convention in Connecticut, I do not know just what conclusions would be reached, but I would venture to say that all would agree that the improvement of seed would have a marked influence on the crop production of this state. It is, therefore, my intention to present to you the results of investigational work which we have carried on at the Ontario Agricultural College in connection with crop improvement as influenced, particularly, by better seed.

In each of the past eighteen years two leading varieties of oats, barley, spring wheat, field peas, spring rye, hull-less barley and emmer have been grown in our experimental grounds under uniform conditions of soil and climate. The object of this experiment has been not so much to compare one variety with another as to secure definite information regarding the relative productiveness of different classes of farm crops. It is strange, but nevertheless true, that but little definite work has been done at agricultural experiment stations in comparing in this positive and comprehensive way the relative productiveness of our most common grains. As the experiment was conducted in duplicate each year, it will be seen that we now have the results of thirty-six separate and distinct tests conducted in the eighteen-year period with these seven classes of farm crops. In some years the experiment was conducted on high land, in other years on low land, and in others upon land which had a gentle slope; in some seasons facing the northeast and in others the southwest. On no occasion was this experiment conducted on particularly heavy or especially light soil but on loam which varied somewhat from year to year from fairly light to medium heavy. The results of this experiment are very interesting.

In order to add to the value of the results of this experiment, we have used the tabulated results of the digestible constituents of the different classes of crops as presented in the fifteenth edition of the book entitled "Feeds and Feeding" written by Henry and Morrison and printed in 1915. By multiplying the yields per acre by the percentage of digestible constituents given for each crop, the amounts of digestible constituents per acre have been worked out. When these constituents are added, it gives the total amount of digestible constituents per acre for each crop. It should be understood that the digestible fat is usually estimated as being 2.25 times as valuable as an equal amount of digestible carbohydrates. The following table gives the results of the thirty-six distinct experiments conducted within the past eighteen years:

CLASS OF CROP	Average Annual Yield per Acre (18 Years, 36 Separate Tests)					
			Pounds of Digestible Constituents in Grain			
	Straw (Tons)	Grain (Lbs.)	Crude Protein	Carbohydrates	Fat	Total
Barley	1.74	2673	240.6	1785.6	42.8	2069.0
Emmer	1.97	2548	242.1	1610.3	43.3	1895.7
Oats	2.30	2591	251.3	1349.9	98.5	1699.7
Wild Goose Spring Wheat	2.16	1955	215.1	1255.1	31.3	1501.5
Rye	2.17	1760	174.2	1203.8	21.1	1399.1
Field Peas	1.49	1815	344.9	1012.8	10.9	1368.6

It will be observed from the foregoing table that in the average of thirty-six separate tests covering a period of eighteen years, barley gave the largest weight of grain, and oats the largest weight of straw per acre. Rye gave the lowest yield of grain and field peas the lowest yield of straw. It will also be observed that for the eighteen-year period barley has given an increase over the oats of 82 pounds of grain per acre per annum.

In digestible food constituents per acre field peas was the highest in crude protein, barley in carbohydrates, and oats in fat. In total digestible constituents, barley surpassed the oats by an average of 369 pounds per acre per annum.

An interesting and valuable experiment has been carried on at the Ontario Agricultural College in which different selections of seed of various classes of grain have been tested from five to nine years. For this experiment seed was taken each year from a general crop of grain grown either on the College farm or in the Experimental Department. It will be understood that whatever difference there is from the influence of the selection of seed, that difference is attributed entirely to the careful selection of the seed for the separate years in which the tests were made. The results show the influence of one year's selection, and are, therefore, of special interest to the practical farmer. For the large plump seed none but well developed grains were selected; for the small plump sample the grains selected were of a uniform character; and for the shrunken sample none but shrunken grains were used, the last selection being made regardless of the size of the kernels. The sample of broken grain in the case of barley, and also of rye, contained nothing but grains which had been broken crosswise; split grain, in the case of winter wheat, contained nothing but grains which were broken lengthwise; and split seed, in the case of peas, contained peas which were split and not broken. The grain from which these selections were made was all threshed with a grain separator, and the splitting and the breaking of the grains were, therefore, done in the usual process of threshing. In the selection of large, plump seed, one-half pound was carefully weighed from each class of grain. The number of large, plump seeds of each kind of grain was then counted and a corresponding number was taken of the medium sized grain, the small, plump grain and the shrunken grain. In the case of the broken or split grain, twice the number of the half kernels, as compared with the whole grains, were used. The different selections were carefully sown upon plots of similar size. The following table gives the average yearly results of each selection made from six different classes of grains.

Class of Grain	Selections	Number of Years Tests Repeated	Weight Per Meas'd Bushel (Pounds)	Average Yield per Acre per Annum	
				Straw (Tons)	Grain by Weight (Bushels)
Oats	Large seed	7	33.2	1.9	62.0
	Medium-sized seed	7	32.2	1.8	54.1
	Small seed	7	31.8	1.8	46.6
Barley	Large Plump seed	6	49.5	1.5	53.8
	Small plump seed	6	48.8	1.5	50.4
	Shrunken seed	6	49.1	1.4	46.0
	Broken seed	6	48.6	1.3	43.2
Spring Wheat	Large plump seed	8	59.1	1.4	21.7
	Small plump seed	8	58.3	1.3	18.0
	Shrunken seed	8	56.9	1.2	16.7
Spring Rye	Large seed	5	53.3	2.0	26.0
	Medium-sized seed	5	53.3	2.0	24.4
	Small seed	5	53.5	1.9	22.3
	Broken seed	5	52.8	1.6	16.9
Winter Wheat	Large plump seed	6	59.4	2.6	46.9
	Small plump seed	6	59.2	2.2	40.4
	Shrunken seed	6	59.1	2.1	39.1
	Split seed	6	54.2	.6	9.3
Peas	Large seed	6	56.3	1.3	28.1
	Small seed	6	56.3	1.1	23.0
	Sound seed	9	58.1	1.4	29.2
	Split seed	9	57.9	.6	10.2

One year's selection of seed grain has a marked influence on the resulting crop. In every instance, the large plump seed gave a greater yield of grain per acre than medium-sized, small plump, shrunken or broken seed. In the average of the six classes of grain the large plump surpassed the small plump in yield of grain per acre by nineteen per cent. and, in the average of the three classes of grain, the plump seed gave a yield over the shrunken seed of twenty per cent. It should be understood that equal numbers of seeds were used in this experiment. The results throughout show that a large plump seed will produce a larger, more vigorous and more productive plant than is produced from a small plump or from a shrunken seed. Other experiments are now being conducted in which different selections of seed are used at different rates of seeding. In all experiments the results are in favor of sound, plump seed of good size for grain production.

A large amount of experimental work has been conducted at the College within recent years to determine the influence of different selections of root seed upon the resultant crop. Four tests were made annually with the different selections of seed of the field roots. Duplicate experiments were conducted in which the seed of the different selections were planted separately, and duplicate experiments were also conducted by planting three large, five medium, and eight small seeds at each place where it was desirable for a root to grow. The plants were thinned to one at each place, and at equal distances apart. When the roots were harvested the yields of the duplicate tests of each method were averaged. The following table gives average results of the duplicate test made by means of each of two methods of comparison in order to ascertain the amount of influence of the size of root seeds on the yield of the roots produced:

Method of Planting.	Roots.	Number of Years' Tests	YIELD OF CROP PER ACRE		
			Large Seed (Tons)	Medium Seed (Tons)	Small Seed (Tons)
Plots in which equal numbers of seeds were planted separately.	Mangels	5	31.19	27.02	18.57
	Sugar Beets	5	23.25	21.32	13.48
	Swede Turnips	5	15.35	12.63	7.03
	Fall Turnips	5	26.72	22.00	13.55
	Field Carrots	5	22.32	19.31	13.59
Plots in which equal numbers of plants were left when thinning.	Mangels	5	35.17	32.23	24.47
	Sugar Beets	5	22.54	22.37	15.05
	Swede Turnips	5	18.77	17.85	10.40
	Fall Turnips	4	26.14	25.35	24.00
	Field Carrots	5	26.62	25.13	18.87

NOTE—In the case of mangels and sugar beets the seed clusters instead of the separate seeds were used.

In the table here presented we have the average of no less than ninety-eight distinct experiments conducted with large, medium and small seeds of five distinct kinds of field roots. It will be noticed that in every instance the large seed produced greater yields than the medium-sized seed, and that the medium-sized seed produced greater yields than the small seed.

In each of six years whole potatoes have been planted in rows three and one-third links apart and the potatoes were dropped one foot apart in the rows. The experiment was conducted in duplicate in each of the first two years and in triplicate in each of the last four years. It will, therefore, be seen that we conducted sixteen complete and separate tests in the six-year period. The treatment of the land was uniform for the different plots in each year. The following table gives the average results in total yield per acre for the sixteen separate tests of the six-year period.

Selections.	Yield per Acre. Average Six Years. (Bushels.)
Large Whole	338
Medium Whole	274
Small Whole	201

While it is true that a large potato will produce a greater yield than a small one, it is not practicable to use large potatoes for general cultivation as it requires too much seed and there is too large a percentage of small potatoes produced from the large tubers. It is undoubtedly true, however, that the amount of seed planted has a marked influence on the yield of the crop produced.

In an experiment which was conducted in duplicate in each of five years, potatoes of medium size were cut into pieces of different weights. The following table gives the average of the five years' results in testing potato sets of each of six different sizes:

Size of Sets Planted	Eye per Set	Yield of Potatoes per acre per annum (bushels.)
1/16 ounce	1	47.5
1/8 "	1	89.7
1/4 "	1	111.1
1/2 "	1	129.0
1 "	1	148.4
2 "	1	173.9

It will be observed that the size of the potatoes or the size of the sets has a marked influence on the resultant crop.

From the results of the various experiments here presented it will be seen that good seed is at the very foundation of successful crop production.

THE COUNTRY'S NEED OF ANIMAL ENGINEERS.

By Dr. W. Horace Hoskins of New York University,
New York City.

I want to congratulate your organization, the farmers and those on the land who have sensed the prevailing situation in our country for the first time as evidenced by your coming here to commune for a week on the various aspects involving the two great problems that are disturbing the world today—land and food. I am sure we are beginning to realize what we must all come to in a very little while, that is, a larger community work, greater co-operation, and the correlating of all our forces. During the last four years we have passed through the most remarkable period for we have had to learn the lessons at a tremendous cost and now we must of necessity realize that community interests will be at the bottom of the real solution of many of the problems.

The problems of land and food we have seen have disturbed the earth, and the spirit of unrest that exists today in three-quarters of the earth geographically, and three-quarters of the earth numerically, will not end in any permanent peace until these two great problems are better solved. We cannot have nations underfed without the spirit of unrest abounding throughout these nations. We cannot have underfed children and have strong men and women, and therefore these two great problems are linked indissolubly together.

In our own nation, rich, extravagant, careless and indifferent in times past, we have felt the pinch of a shortage of food. With 500,000,000 acres of idle land, single states like New York, for instance, with a population of 10,000,000 people, and 15,000,000 acres of idle land, with but 9,000,000 under cultivation, according to the federal farm bureau has more farm mortgages than any state in the New England or the Middle States. A nation of 100,000,000 people, where up to 1840 fifty per cent. of the diet of the people of the United States was animal food diet, the last estimate, made some five or six years ago, was 33 1/3%, and I am quite sure it has been reduced to 25% or less since then. I say we have been careless and thoughtless, or our losses would have bankrupted us or any other nation save our own. In the last ten years we have averaged in losses $210,000,000 a year in our animal food supply. Last year our loss was $250,000,000 among the animals that made up our food supply.

Now the trouble about these losses was that they have fallen on the shoulders of such a large percentage of the population of our country, more than 50% of those who are on the land. There has been so little of community interest, so little co-operation between the people on the land, that whatever protests they have made against these tremendous losses have fallen without any radical result in the shape of protection. I have long believed that the great problem of any city or community is a pure, abundant, wholesome water supply, and I have equally believed that the greatest province of all legislation is the highest possible protection it may give to its people from a health point of view. There has been too little effort to join the issues of those in the large cities representing 50% of the people, and the 50% who are on the land; both have thought their problems were entirely different, while their problems were one and the same. The people in the large cities cannot get along without the food that is produced on the land, and when I say "food" I speak of it in the sense of wool that comes from the backs of sheep, of leather that comes from the skins of sheep, or the hides of cattle or sheep that we may kill for food, or it may be hogs. Whether it be the milk products of our dairy cows, or whether it be the relation of animal diseases to man, they are all involved in the great food problem, and those in our large cities are more deeply concerned as to proper legislation and control of these matters than even those on the farm on whom the direct losses invariably fall. There has been so little support through public sentiment in affording the animals that produce our food and give fertility to the soil, produce the cereals upon which we exist, so little regard paid to their interests in the way of protecting them from the diseases that have caused such tremendous losses, as to make farming in our country unprofitable to so many. Profitable farming cannot exist without profitable animal industry, and no country can lose the amount that we lost in the direct losses that can be calculated, not to speak of the shrinkage in values which cannot be estimated, and have profitable or successful farming. Neither will we ever get rid of the spirit of unrest that exists in the large cities until we can afford them a larger and cheaper food supply.

When I tell you that 23% of the little children in the schools of New York are underfed today, it isn't hard for you to conjecture the great problem to take care of those little ones when they become men and women, and what a burden and liability they are going to be on the community. When I tell you that from the increased cost of milk the consumption in one section of our city has decreased two hundred quarts a day, it is not hard to estimate what is going to become of the little ones that are denied this valuable food so essential in the growing period of their lives. The remedies that are proposed by the public press and the controversies that are existing today between the producer and the distributors are not the solution of the problem at all. One may today read the challenge of those who are engaged in distributing milk and tomorrow he may read the reply of those engaged in the production of milk. But there is one thing which is very patent, however, and that is, there never seems to have been a time in any of the large cities that distributors of milk did not prosper, or that they were anything but prosperous. On the other hand, if we are to judge by the amount of idle land in New York and by the increase of tenant farms and tenant farming which is going on in the Middle and New England States, we must realize there has been one great continuous loss on the farm or this condition would not exist. Life on the farm will always have an attraction for men and women and even children as long as the world exists.

So I come to you with the thought that perhaps additional legislation is not so badly needed as it is for public sentiment to support the state in using the protective methods for the control of the great sources of these tremendous losses through laws and statutes now existent. I have been delighted in the last two or three years to notice that Connecticut is stepping forward in better plans for the conserving of animal industry, and is planning now for a larger and a better system for controlling the infectious and contagious diseases of animals; and the losses that have driven so many off the farms. These losses are largely controllable, and a perfectly wonderful work has been done in this country. The plans for handling and controlling these diseases are now well enough known for public sentiment to support those who are doing this work in every state to the fullest limit, because in so doing they will contribute in a larger measure to settling the spirit of unrest that exists in the large cities all over the world.

The Bureau of Animal Industry has eliminated the Texas cattle tick in 400,000 square miles of southern territory. The quarantine line maintained from the Atlantic to the Pacific Oceans which has been so extended and this land made available for growing cattle, which was not possible before because of the danger of Texas fever spread by the tick. It was observed for a long time in Texas that the years there were no cattle ticks there was no fever, and so it became a byword with those men "No tick, no fever," and therefore no losses. Through methods adopted by the Bureau of Animal Industry in co-operation with the states, they have eliminated ticks from 400,000 square miles, leaving 275,000 square miles to be cleaned up.

So we may look forward to the south becoming one of the greatest live stock sections of our country, without the tremendous losses that have occurred incident to our animal food supply, grown so largely upon our western plains.

But we must look for larger work than this. We have in the City of New York 6,000,000 people ready to buy any kind of animal food product that can be produced. The highest price can probably be obtained there of any center, and a very large source of the supply is sent from nearby states. I have coined the word "Animal Engineers." Through these I hope we shall learn to district or zone the states, and place in each zone or district an animal engineer, a man capable of telling that district what kind of animals can be raised there most profitably; that we shall have in every one of these districts a community slaughterhouse where any one raising animals may take them and have them slaughtered under the best conditions to insure the wholesomeness and safety of the food, where everyone may go and have his animals slaughtered on just the same terms. A very significant statement was made by your distinguished senator in Washington, that in his desire to respond to the call for the raising of more food animals, he had raised an additional number of sheep, and when they were ready to be slaughtered and sold for food he could find nobody in his community ready to buy them or no place where he could have them slaughtered and obtain for his efforts a just compensation for this service.

In addition to the community slaughterhouse I want to see the community conservation establishment where the farmers can take sterile and unprofitable animals which they no longer desire to keep, and have not the time or do not wish to go to the expense of digging a hole, and there get the value of the animal from a salvage viewpoint.

During the last four months we were 4,000,000 pounds short of glycerine in this country for the making of munitions to carry on the war. Glycerine had risen from ten to sixty and seventy cents a pound, and we had 5,000,000 horses out on the western plains with no future. These horses would have furnished ten or fifty times the amount required, but we had no means of utilizing them and they were eating their heads off in forage that ought to have been feeding sheep or growing cattle. They were too small for any artillery or cavalry purposes, and their use was no longer needed in the small cities and towns where the small autocar had displaced them.

We have heard for many years that the great curse of the sheep industry was dogs. We shall never get away from the ownership of dogs as long as man lives, but the problem of solving the dog problem is a very simple one indeed. The zone or district system in your state will solve it. The gathering of the homeless or non-taxed dogs through the service of the humane societies of these districts will eliminate them, and no man who loves the dog would be unwilling to pay a sufficient tax each year to take care of the losses that will occur through dogs killing sheep, for it is rarely the household pet or the well-fed dog that commits these depredations.

These animal engineers would look for the infectious and contagious diseases in the community and prevent their extending into other districts. They would devise plans for the control and the reduction of the diseases that may prevail there, and adopt preventive measures. Last year $400,000 worth of sheep were brought from the ranches in Oregon across the continent into the State of New York, without any inspection whatever that would afford any security to the buyers of those that they were not affected with the same diseases that had driven the sheep industry out of the east thirty or forty years ago. In 1870 New York had 5,000,000 sheep; in 1916 it had 400,000 and 15,000,000 acres of idle farm land. What is needed is simply the creation of public sentiment to support the plans that states are now evolving, looking to the conservation of a larger animal industry, and your state is taking a leading part, I am proud to say. You are going to contribute to the well-being of all the people of your state, and we are going to continue in a very much larger measure in helping to solve the spirit of unrest that exists in the large cities. And so I want you to carry this thought away, that the one great problem that we have is that of conserving animal industry, and that must be done by a larger protective plan from these diseases which have been so destructive and which have so largely contributed to making farming unprofitable, and have greatly robbed the land of its fertility, to which they contribute its richness.

When you see in a large state like New York, public sentiment supporting the expenditure of $150,000,000 on 12,000 miles of state highways going along 15,000,000 acres of idle land, and tell them what it is possible to do in conserving animal industry, and the need of appropriating large sums to save these interests, public sentiment will support it, and we shall get better conditions all over our country. We shall have less crime, less poverty, less discontent, because these conditions never prevail where people are well fed.

We will have learned better the lesson that you and I are our brother's keeper. We will establish a true brotherhood of mankind. We will taste of a new christianity, that will fit world conditions, not state's or nation's, but a kind that our Master lived and exemplified in his teachings.

THE FARM FLOCK

By E. L. Shaw, of Morgantown, West Virginia.

I think the most of you realize that the sheep is the most timid animal that is produced on the farm. It is the sheep that has to have some one to look out for it. Most of you realize when you have gone out to buy sheep during the past few years, that a dollar doesn't go as far as it used to. There never was a time in the history of sheep raising in this country when sheep have sold for such prices as they have during the past few years; the cause being that from 1903 to 1917, a period of but fourteen years, the number of sheep in this country decreased over 15,000,000 head. In 1903 we had the largest sheep population in this country ever known, 63,500,000 head. From 1903 to 1917 the number of sheep in this country decreased over 1,000,000 head per year. So I say that the present high prices, or the high prices that prevailed for sheep during the past two or three years is a result of the scarcity of sheep in this country.

During this same period that the number of sheep in this country decreased 15,000,000 head, the population increased over 26,000,000. In other words, instead of the number of sheep or the sheep population trying to keep up with the human populace, those two lines have been going in opposite directions.

Now we want more sheep in this country, but we are going to have a readjustment of the sheep industry in the United States. Years ago, it was claimed, that the farmers in the eastern part of the United States could not compete with the men out West on the ranches, and that was absolutely true, every word of it. Out there at the present time a great many of the sheep men are cutting down the number of sheep or going out of business, and I hear an echo at the present time that the sheep industry is coming back to the eastern part of the United States. It has been more or less of a toss-up between Wyoming and Montana as to which had the larger number of sheep. One year Montana would be ahead, and then it would have a severe winter and Wyoming would be ahead. In 1917 Montana dropped from second to fifth place, and Ohio moved from fifth to fourth place, and today we find Ohio with 3,000,000 head of sheep.

Now there never has been a time, I believe, when the eastern farmer had such a golden opportunity for sheep raising as at the present time. Under normal conditions we only produce in this country about one half of the wool we use. As I said a moment ago, we need more sheep in the United States, and we are going to find there will be a high percentage of sheep produced on the farms east of the Mississippi River. During the past two or three years we find thousands of farms that are establishing flocks to produce more wool in this country.

Now you can go into any farming state in the Union and get up before an audience like this and talk about sheep raising, and you will see some gray headed man who will say "I used to have sheep and I would like to get in the sheep business if it wasn't for one thing." And you hear that not only in Connecticut, but in Ohio, New Hampshire, and any other farming state in the Union. It is the dog proposition. Now we can hardly realize the value of a good dog until we have an opportunity to camp out with the sheep herd on the western ranches. I want to say that it is simply wonderful what one man and one dog can do in handling a flock of sheep. From the standpoint of the western country I say it is wonderful what the dog has done to develop the sheep industry; on the other hand, I say in the farming states of this country it is absolutely terrible what the dogs have done to drive thousands of sheep men out of the business, and prevent thousands of farmers from going into the sheep business.

Now that dog proposition is a mighty important one, and I am going to take a few minutes to discuss it. I know that the people are interested in raising more sheep, because we have thousands of acres of land in this State of Connecticut which are carrying very few animals. Now how are we going to solve the dog proposition. The most important thing to do, my friends, is to produce more sheep. If we solve the dog proposition we have to get more public sentiment back of it, because if more people are interested in raising sheep, more will be interested in solving the dog proposition. In New York we have a new dog law, and they brought $400,000 worth of sheep into the State of New York last year. If there is only one man in the community raising sheep, it is pretty hard to fight the proposition single handed; and if any dog disappears the blame is put on him. The first thing we want to do in all the states is to get the people interested. Then we are going to solve the dog proposition. We have one county in West Virginia that has about 1500 sheep, and in the neighborhood of 5,000 dogs. A coal miner in our state was asked how much property he had. He hesitated for a moment, and said, "I have household goods valued at $10.00, and I have seven dogs, worth $350.00." That is one illustration in this state. But in one county during the past year we reduced the worthless curs by over sixty per cent. So I say the first important thing to help out in the dog problem is to raise more sheep. Second is to have a good dog law. If people don't understand the dog proposition and won't take care of the dogs the way they should, it is necessary for us to have a law that will compel them to look after them. I could never understand why it was or why it is that the majority of people think that a dog ought to have as much or more privilege than a human being. Now that is true in a good many cases. Somebody's dog comes out and follows you snapping and barking. What would you think if the owner of that dog came out and tried to pick a fuss with you? You wouldn't stand for it, would you? Let the owners create the same amount of damage to property, etc., as their dogs do, and they would get a dose of shot. We need to get a good dog law in every state in the Union. The legislatures have been kind enough to pass a good dog law in our state, and Ohio passed one of the best dog laws ever proposed in the Union, and they have 3,000,000 sheep there and they want more sheep. If you haven't a good law, the present session of the legislature ought to give you one of the best laws that has ever been passed in any state in the Union.

In the first place, we want a dog law to impose a certain tax on every dog. If we had that it would rid the country of a lot of worthless dogs that owners won't pay the fee on. The first thing we want is a tax, a medium tax. Further than that, we want to make every dog owner responsible for the damage of his dog. Just as soon as we make the owner responsible we have solved the dog proposition.

I want to mention one thing in connection with the dog that is a mighty important thing, and every dog owner whether he lives in the town or the country can co-operate and help solve this problem. Now what is it? My experience in the sheep business has been that about ninety per cent. of all the sheep that are killed by dogs, the operation is performed at night, and that is why a good many dogs get away with it, because the owner is not up and doesn't have an opportunity to kill the dog. Now I believe every man ought to have all the dogs he wants, if he will keep them where he should. Ninety per cent. of all dogs are like weeds, they are out of place. If you have use for a dog, it is a mighty valuable animal, but generally they are here, there and everywhere. Why can't the people in a community agree to keep the dogs tied at night? No matter how many sheep you have in Connecticut, you don't want a dog in your flock of sheep. He may kill a half dozen, but the others will be injured by the fright. I have seen a flock absolutely ruined where a dog has been among it. I made that statement at an Extension School Institute meeting in one of our counties. A man in the audience went straight across the street to a hardware store and bought a chain. Then he came to me and said "I will guarantee that my dog won't be the cause of driving my neighbors out of the sheep business." I think that man is to be congratulated.

Now, going down the line a little further, I know at the present time one of the great drawbacks to sheep raising is the fence proposition. In Ohio they use the dog proof fences. If you can't afford it, you can have a corral on your premises where you can put your sheep at night.

Another consideration is the use of sheep bells. I wouldn't think of running a flock of sheep without bells. If your sheep are being disturbed, you hear the bells, and have an opportunity to get out and save your sheep. I think we can raise more sheep if we have a good dog law and the farmers co-operate with bells. Then we have a combination where we can raise sheep. They are doing it in Ohio, and what they are doing in Ohio you can do in Connecticut.

Now if we had the dog proposition solved, we would have enough trouble in raising sheep. I am going to talk about the parasite proposition. In some sections of the country we have little loss from dogs, but we find a good deal of loss from parasites. Parasites at the present time are causing heavy loss with the sheep of this country. Probably 1918 was one of the greatest years for parasites we have ever had in this country, but I believe, in fact I know, that by proper management, by our care in food, etc., we need not worry about the parasite proposition.

We are advocating that farmers raise more sheep, because they are profitable. Take away the small flocks from the farms we have in West Virginia, and many of those farmers in a short time would go to the poorhouse, because we find that among those farmers their sheep are bringing in greater profits then any crop on the farm, $5.00 to $15.00 per head profit.

I can mention about forty or fifty reasons why you should raise sheep, but the most important one is that the sheep is an animal that will consume more products of your farms that would otherwise go to waste than any other animal. Sheep will consume about 90% of the weeds, and cattle about 50%. Where there are sheep raised on the farm you will find very few weeds. One of the most important reasons why you should have sheep on the farm is to keep down the weeds and utilize a lot of vegetation that would otherwise go to waste.

We are advocating that farmers start on a small scale. I believe that on most of the farms in this country there is room to fit in with the cattle and with the other kinds of live stock a small number of sheep, up to forty head. It is a question of how many sheep your farms will carry; how many can you keep with your other live stock and keep them healthy. There is not anything more disgusting when they are infested with parasites, and there is not anything nicer when they are healthy than the sheep. Owing to the fact that sheep are high in price, be contented with starting in with a small flock. Sheep multiply rapidly, and in a few years if you give them the right kind of care you are going to have all the sheep you want. A great many people have the impression you can't keep sheep where there are cattle. One of the best flocks I ever saw was a flock of twenty-five breeding ewes which were kept with twenty-five dairy cows, and I have never seen a healthier flock. Now it has been true that when sheep have been high or wool selling for 70c a pound as last year, people have a tendency to rush into the industry. I want to give you one illustration, because it will bring out the point very nicely. We had one man in our state last year who had the sheep fever, so he went to a neighboring state and purchased a carload of 200 head of breeding ewes. He kept those sheep four months. He lost sixty of them, then at the end of four months he put them up at public auction and sold them for $6.75 a head. He is out of the sheep business.

On the general farm there is a place for a small flock of sheep, but there are men owning farms, who are capable of raising and keeping a large flock. In raising any kind of live stock there are three things which are essential, and no man yet has made a complete success in raising any kind of live stock unless he had these three things in mind; well bred, well fed, well cared for.

Those are the three things to which you have to give attention if you are going to make a success of raising live stock. I know of a man who purchased one of the best flocks of sheep in the United States. He didn't know much about the business, and inside of five years he had given it up.

We are advocating in West Virginia that the farmers in a county or community co-operate, and adopt if possible, one breed of sheep. Probably in Connecticut there are certain men who produce fifteen or twenty lambs. When they are ready to sell, how are they going to dispose of their stock? If one neighbor had fifteen or twenty lambs, and another neighbor had fifteen or twenty, a little co-operation in disposing of the lambs and wool would help them out. It is working out in Tennessee, and it has worked out in West Virginia. So adopting the same breed of sheep in a community or a county is going to be a valuable thing to solve the sheep problem. It is going to be a good way to sell your products.

Now I have a chart here which I am going to show you, because it shows that forty-eight states in this country are raising sheep, and these are arranged according to the number of sheep. Starting with Wyoming, the greatest sheep state in the Union, we come to Montana, which I believe should be the greatest live stock state in the country, dropped to fifth, and Ohio moved to fourth. Now Connecticut is almost off the map. Connecticut is the forty-sixth sheep state in the Union as regards the number of sheep. When Connecticut has so much land that will carry sheep, it is a pity that it is so far down the line, because I believe that when properly handled sheep are among the most profitable animals that can be kept on any farm, whether in West Virginia, Ohio, or any other state.

In looking over the program a little while ago I made the note that you have a Connecticut Sheep Breeders' Association, and I want to congratulate the farmers and sheepmen of Connecticut in taking the steps they did in organizing a Connecticut Sheep Breeders' Association, because when the farmers and sheep breeders get together they are going to be in a position to solve some of the problems and help each other a good deal. In closing this afternoon I want to say that Connecticut ought to have more sheep, and the motto for the sheepmen in Connecticut ought to be "More Sheep and Better Sheep."

In the absence of Mr. Curtis the following paper was presented by George V. Smith.

POULTRY IN THE RECONSTRUCTION

By George V. Smith, West Willington, Conn.

There are some things I think it well for us to think about in considering poultry husbandry in this so-called reconstruction period; some things that a New England audience should have called to its attention.

I am speaking to a New England audience, and I would not like to limit myself to the State of Connecticut, even though this Farmers' Week is purely and primarily a Connecticut institution, because what we need to have is a program that is great and broad enough to compass New England as a territorial entity. We people must recognize the fact that New England as a trade proposition is a territorial entity, and Connecticut is only one unit in it.

Poultry in Reconstruction. That topic would seem to indicate that the poultry business does need reconstruction. Of all the agricultural industries, the one that has suffered most in the late crisis has been the poultry business. The very fact that that industry slid down hill more rapidly and bumped harder when it struck bottom than any other is all the more reason we should give attention to certain reconstruction problems. The worse the disease, the more important the cure.

Did the poultry business in these New England states, in the Southern states and perhaps in the Rockaway section of Maine, did the poultry business in these states slump because of a weakness in the industry itself? In other words, was the industry itself fundamentally wrong? No, it was not. No branch of agriculture that concerns itself with the production and development of a vital food product is fundamentally stronger. Why did the poultry business slump as it did? I suppose this program is primarily designed to reach some of these fundamental things. Let us think.

As I was quickly drawn up here, I had to take my cue from someone else. With all apologies to Professor Shaw, I am going to "grab his thunder." He spoke of about ninety per cent. of the food of sheep being in gleanings from the farm. In other words, sheep are scavengers. How about cows? Cows are not scavengers to the extent that sheep are, but nevertheless cows are scavengers for they consume that which nature provides on your farm and on my farm, though we provide some grain. Hogs the same way. Let us think that way about all the animals on our farms. Let us think a minute about the hens on your farm, and the hens on my farm,—the only farm animals that are primarily competing with your mouth and my mouth. The hen is the only animal, therefore, we have in the New England states that is primarily and fundamentally competing with the human appetite. Now let us think reconstructively. When a farm animal like the hen is competing with the human appetite, that farm animal in this case is laying an unwarranted burden upon stocks of food primarily designed for human bodies, is laying a burden on the great transportation lines that are already over-burdened in bringing other products to us, and it is worth our while therefore to take into serious consideration the poultry reconstruction problem of poultry being a scavenger proposition. Let us begin to think for ourselves, as New England people, what we are liable to face, and how we are going to face it when it comes to us. Poultry,—hens—by rights are scavengers, but is poultry here in the same position as sheep and swine? They are not competitors with the human appetite. Of course we have never looked upon hens in any other light, but in the great Central West and beyond that, where the poultry industry is run almost exclusively as a scavenger proposition, what takes place? It is a farm crop; it is a crop that dovetails in with three other departments, two great departments and one department substitute,—with hogs, with cattle, and with grain. There is no time from January 1st to December 31st inclusive when those hens cannot get their own food. Hens on those farms, in the Plain States cannot gain their food unless it goes across the country to them. Hens follows hogs, cattle and grain, and therefore the hens in that part of the country where they produce these things are scavenger animals. It is the same way on the Pacific Coast.

I dare say that many of you have been very much interested in the price of eggs this winter. No doubt you have turned to the market reports that appear in New York papers on butter and eggs. We have found that since early last fall the average of a solid train load of Pacific Coast white eggs have gone into the New York market alone, and almost without exception those Pacific white eggs produced over three thousand miles from the Atlantic seaboard sold at prices not more than two cents under the prices that I could get for my chalk white eggs in the same market. During two weeks this past winter the Pacific Coast eggs sold on the New York market dollar for dollar with the eastern nearby whites. Those people got onto the job and put the eggs up as they ought to be. One dealer said to me, "We don't have to open a case of those Pacific white eggs. We know what is in the cases without looking at them." My thought is this,—we are already getting a carload a week in one market, New York. What is going to happen when the same amount of business judgment and care in putting up that product reaches the Plain States where the great volume of this poultry is produced? What is going to happen to us when the enormous production of poultry products of the Plain States in addition to those of the Pacific Coast is moved to the Atlantic seaboard and dumped on our markets? It is the thought that is squarely up to us today in this reconstruction problem. We have got to reconstruct our poultry problem in these New England states to make provision for this competition that is coming to us,—that has already come to us at the rate of a solid carload a week. What are we going to do with our high priced grain that we are feeding these birds?

We have got to get this poultry business reconstructed in such a way that will make our poultry as nearly a scavenger proposition as we can. Upon our general farms we must raise as much of our poultry food as is possible for us to produce. But with the large number of hens we keep on our farms, we haven't enough land to produce sufficient grain for those hens to consume. The eggs from the great producing sections are coming here and are competing with us, and they will be produced at such a low cost that they will undersell us. But the Pacific Coast whites and the Plain States' eggs are not going to be distributed on Farmington Avenue, they are not going to be distributed on Whitney Avenue, New Haven; the wholesale districts of Hartford, Springfield, Worcester, and so on. They are going to be distributed at a price to reach a certain class of trade, that you and I do not want or intend to deal with. Now we have got to feed our hens western grain. We have got to take that thought into consideration. It is going to cost two or three times as much to produce these eggs as those from the West. You and I have got to become merchandisers. Those eggs are coming, and you and I must put up our eggs of fine quality and serve the high-class trade in these nearby cities. Then it is our proposition to produce a fine quality of eggs to sell to a nearby market, the exclusive trade, at big prices. Under no circumstances attempt to produce eggs on your farm that will go via the country store clerk to a jobber. Face to face with a western product, we do not get anything for it.

Today the poultry industry in New England is beginning to come up again. We are beginning to feel too optimistic. The danger is, the pendulum is going to swing too far the other way, and we shall be overloaded with eggs produced under careless conditions. When we do get up against the eggs that are coming from the West it is going to discourage us. But we need not be discouraged if we will bear in mind that we must produce such fine eggs, such fine fleshed fowls that we can sell to the exclusive trade, and let the western eggs come and drift into the markets, that our eastern people would accept under no circumstances. But produce in the same old way,—tolerate the hen on our farms and sell the eggs just to get rid of them,—and it wrecks the whole reconstruction program. I say this with all the sincerity I can possibly put into my words. If it is your purpose to keep a flock of hens for one purpose only, to swap in that product at the country store for what the country storekeeper is able to give you, then you are going down in front of that wave that is coming here from the West. If you will produce eggs with just as much care as the ladies take in the production of nice dairy products, you need have no fear of the Pacific Coast whites or the Plain States' whites. It is up to you. We are doing it, and we are going to do it, and we shall win, because we recognize that these nearby markets are the finest in the world, and it is the people who live in these nearby markets who pay the best price, and it is up to us to produce fine quality eggs to meet that demand. But in a general way, if I had to go into the poultry business, and saw no outlook except the country store, I would put my money in dairy cows.

OUR AGRICULTURAL PROBLEMS

by Hon. Joseph W. Alsop, Avon, Conn.

We have heard a good deal about the labor question. Personally I feel very sure that the labor question will be discussed with equal seriousness at any meeting of farmers five years from now. It was discussed in the same way five years ago and ten years ago, and it is always going to be one of our most serious problems. It is so in every line of business, always was and always will be.

Now there is one thing that it seems to me from my experience as I have gone around among the farmers and among the tobacco plantations, that we ought to seriously think about. I believe it is the greatest secret of any in getting good help and keeping it,—that is, to have good houses for them to live in. I believe the best investment I have on my farm today is eleven tenements which are in good condition and nicely taken care of, which I rent to my men at $6.00 a month. I noticed that some of the tobacco men around 1914 began to have tremendous difficulty in getting help. You could go around and pick out plantations that had good houses for their help to live in; they were the fellows who had the help. Now you can't get married men to work on farms unless you have reasonably good houses for them to live in. It is to me the secret of keeping men on the farm.

There is one other thing about farmers' labor question we sometimes forget, and that is, that what we are buying is service. A man comes to us,—a very good man who has been on the farm a long time,—and he wants his wages increased. He wants to get what we think is a pretty high wage, and we say "I can hire a man for less money than that," and we hire some new man. Now manufacturers estimate it costs about $60 to hire a new man. Every time he brings in a new man he is going to lose that on damaged machinery and lost time. There is no business in the world where the experience of the help, and the experience of the help on that particular farm, is of more importance and of more value than it is now. The knowledge of where the buildings are, where the fields are, what was grown in them last year, that very knowledge is worth a good deal of money, and I think we forget that a man who has been with us, a reasonably good man, for a number of years, and who knows our farm and takes an interest in our business, is worth a good deal more money than a green man. I don't think we differentiate enough between our labor.

We have got plenty of problems. We are going to have before us in the next few years. It is pretty hard to talk about them, because we don't really know what they are to be. We tobacco men thought that the millenium was about to arrive last August when the tobacco buyers ran out and snapped up our crops at twenty cents per pound more than we had ever sold it for. They went those two days, but haven't been since, and we are inclined to call them some pretty bad names. I have been very sorry to see in some of the magazines their pretty near Bolshevik editorials, I haven't any use for the talk that some of our agricultural magazines make against men who are in our line of business. In the dairy business I am both a dealer and a producer, and in the tobacco business I was an officer in one of the large corporations; so I know some of the difficulties they are up against. Those people whom we dealt with have had their troubles since August, just as we have; and if they had not had trouble they would have been out buying tobacco since.

This is the point I want to make tonight. The average man around here who produces milk, if he wants to say something terrible about someone, compares him with Mr. Bryant or Mr. Chapman. They are just the big dealers who buy his milk, and for that reason he doesn't like them. Now that isn't the right state of affairs. I acknowledge that every milk dealer buys the milk just as cheap as he can, and every farmer would do the same thing if he had their boots on. I entirely approve of the Connecticut Milk Dealers' Association; and we ought to take care of our business and see that we get what our product is worth. But that doesn't mean that we can't be friends with the people we are dealing with; nor can we say they are crooks, for they have just as much right to say that we are crooks. We have got to get together. The only thing the public ever learns about the milk business is by reading accounts of quarrels that have come out in the papers. Most of them know that they used to pay eight cents a quart, and now they have to pay sixteen or seventeen cents; they know it is white and comes in a bottle; and they really have to have it for their children. Now it is our business to know that milk is the cheapest food that can be bought on the market; it is a food not a drink. We are also aware of the fact that at the present prices of milk our margin of profit is extremely small, but it is better than the margin of loss we used to sustain ten years ago, because ten years ago no farmer who was producing milk, if he kept books could show anything but a loss. While milk is higher in price than it was two or three years ago, the margin of profit has not increased. We know that fact also about milk. Now, wouldn't it be a great deal better business for us as a whole if we farmers and producers could get together with the people who sell our milk direct to the public all over Connecticut, and teach them that it is worth the price as a food. I think we ought to stand right together with our Association and see that we get for our products what it costs, and a fair profit, and I don't think that we ought to treat the other people as if they were enemies of ours. In other lines of business they haggle over prices and still are friends, but it has always been a wonder to me that it is so hard for us to stay friends.

There is another thing the war has brought out to us, and it is a thing I am much interested in. I am beginning to feel as if I were quite an old farmer. I have farmed longer than many of you believe,—since 1898,—and have been on the place where I am now seventeen years. I can see on certain farms in some of our districts a steady falling off in the appearance of the farm and in the general production. I believe it is due to what you might call a one crop system. I think the dairy farmer is making a mistake when he sells nothing but milk, just as I think our tobacco farmers are making a mistake when they grow nothing but tobacco. I heard a statement the other day that interested me very much. A man made the statement to me that Lancaster County, Pennsylvania, which is the principal tobacco county in Pennsylvania, shipped more beef steers than any other county in the United States. Now I never supposed there was a steer in Lancaster County, and when I was told that they shipped more steers out of there than any other county in America, it was naturally very interesting. So I started writing letters to the tobacco men, and to the Connecticut College of Agriculture, and those Pennsylvania Dutch. They are pretty thrifty men, down in Lancaster County. If they have sixty acres of land, they don't grow all tobacco. They grow about thirty-five acres. They have a silo and grow about thirteen or fourteen acres of corn, and they grow some oats or some rye. Then in the fall they ship in some steers. In the spring they sell them, and they take the manure out and put it on the tobacco land. Now I know from my own experience in my own dairy that the fact that I am running a tobacco farm at the same time on quite a large scale, allows me to produce milk much cheaper than I otherwise could, because if you have some other line of industry you can swap back and forth between the two. I believe some of our farmers have found out their mistakes. To-day if you go around through the tobacco country you will find that the men who are growing tobacco and keeping cows at the same time are the most successful of the tobacco growers. I believe it is practical.

SOME FERTILITY PROBLEMS OF THE CONNECTICUT FARMER

By Dr. S. B. Haskell, Agronomist,
National Fertilizer Association, Baltimore.

Probably since the dawn of written history here in Connecticut, Connecticut farmers have depended more on the manure pile than on any other material. This still holds true, despite the fact that in the last forty years there has been a great decrease in cattle, in swine and in sheep. Back in 1880 there was one cow to every 2½ persons, whereas at the time of the last census there was but one cow to every seven persons. In 1880 we had one sheep to every ten of the human population, whereas in 1910 we had but one pig to every 21 persons, and one sheep to every 80 persons.

Our live stock is decreasing both in proportion to our human population and absolutely. The conclusion is inevitable. We must use more and more outside sources of fertility—the chief of which is commercial fertilizer. Otherwise, our agriculture cannot be maintained, and our live stock must decrease because of lack of feed.

Fertilizers Maintain Fertility.

Perhaps from the foregoing you will consider that I am urging the use of fertilizer simply to maintain fertility. As a matter of fact, let no one forget that if properly used it will maintain fertility. Experiments in this country and abroad, extending over a period of twenty, thirty, fifty and seventy years, have amply demonstrated the truth of this statement. At the same time, not one farmer out of a thousand ever uses fertilizer just because it maintains fertility. The great reason why fertilizer is used on Connecticut farms, on New England farms and on American farms, is that of profit. The fertilizer consumer must get back every dollar spent for fertilizer in the form of increased profit and enough more to make the investment really interesting.

Let me illustrate this:

As a boy I lived for a time on the plains of what was then Dakota Territory and what is now North Dakota. The settlers were all of them eastern men, many of them, as was my father, from New England. They had been brought up on farms and had been taught the proper methods of using manure. To many of them the manure pile was looked upon as a gold mine, representing as it did, many potential extra bushels of potatoes, or corn, or oats, or so many more tons of hay. Despite this, did those farmers, those early settlers on the plains of North Dakota, conserve their manure supply and spread it on the land? They did not! Instead of carefully conserving and spreading this manure, there was a time every spring, as soon as the pile had thawed out sufficiently—for you know the winter temperature in North Dakota is somewhere around 40 or 45 degrees below zero—when they carried it to a hollow in a bend of the river, where they dumped it, and later on burned it.

The reason was just this: With land as it was in those days—still enormously rich—and with wheat at the price which it then brought—a dollar's worth of time spent in hauling this manure and in spreading it failed absolutely to bring back a dollar's worth of crop. Therefore, there was only one thing for these farmers to do, which in fact, they did—dispose of their stock manure in the easiest and cheapest way possible.

Fertilizers Used For Profit.

Fertility cannot be maintained unless it is profitable so to do. This holds for all countries, and for all climates, and it is holding true today here in Connecticut. The fact that Connecticut pastures have gone from real pastures to poor pastures; from these down to brush pastures, brush wood lots, and finally, after a course of years to timber lands, indicates that it did not pay to maintain the fertility of our pastures. Yet I believe that the time has come when we must either do this, or go out of the live stock business here in Connecticut. Furthermore, there are acres upon acres of old meadows, of old mowings, growing up to June grass, or to poor redtop, rather than to timothy and clover, which indicates that either it did not pay to maintain the fertility of these grass lands, or that those who might own these lands did not realize that there was profit in so treating them as to maintain them in full yielding power.

I am speaking of these things at length just to drive home the fundamental fact that the biggest of our fertility problems here in Connecticut is that of profit from farming. Given a satisfactory profit such as I believe is going to develop from the work of the organizations which are meeting here today, there is no doubt that it will soon be possible to solve all of the fertility problems in the state. If, however, conditions are such that there can be no profit, then our lands are certain to continue down hill towards increasing poverty rather than to take the turn of the road towards increasing productiveness.

I believe that present conditions tend to a more prosperous era of Connecticut Agriculture. The recent increase in freight rates is looked upon by many as an unmitigated evil. To the farmers of Connecticut, however, this rate may serve as a protective tariff, for it adds to the cost of the food products from the great granaries of the Western States. Furthermore, the fact that today the farmers of Ohio, Indiana and even Illinois are purchasing fertilizer, removes from the New England farm one of the handicaps under which it has suffered for more than a generation, that of competing against land of virgin fertility. Therefore, let us assume that in the future it will continue to be profitable to maintain the fertility of our lands through the use of fertilizer. I believe that it will.

Standard Grades Needed.

The next question is as to how fertilizer can be used, what should be used, and as to whether there is any rational system on which a sound fertilizer practice may be based? I feel free to say that the fertilizer industry has been somewhat negligent in developing such a rational system. They have been over willing to make unnecessary grades. One company will advise one thing for the corn crop, another company something radically different, while a third company may split the difference. The net result of course is to shake the confidence of consumers in the recommendations of the fertilizer industry. I therefore wish to make this the principal part of my talk this afternoon, and to show how possible it is right here in the State of Connecticut to make a list of not over fifteen or twenty analyses, some one of which I believe will fit every farm in the state. I ask you to take this as a matter for study and for consideration, for certainly if the fertilizer industry, as represented by these branches doing business in Connecticut, can come to some basis of standardization, it cannot fail to be of great help to the fertilizer consumers of this state.

Fertilizer for Fall Seeded Crops.

Let us take in the first instance, fertilizers used in the fall seeding of grass or clover, or of winter wheat and of winter rye,—practically all of these crops, even the legumes, have need of some available nitrogen, simply to start the crop. I will suggest that in our fertilizer mixture for these crops we include two per cent. of ammonia, for this purpose, and no more. To increase this quantity is comparatively useless, for the reason that the surplus will probably be gone before the coming spring. On the other hand, to decrease it is perhaps to reduce the quantity of available nitrogen to such an extent as to retard most seriously the fall growth of the new seeding.

For phosphoric acid experience has shown that a fairly large quantity is needed. We are suggesting those analyses carrying either 10 or 12 per cent. so as to insure that the fertilizer as purchased is highgrade.

For potash much depends upon the soil. Sandy soils are more responsive to potash than are clayey soils. Also on the live stock farm there is less need of applied potash than there is on the farm where but little manure is produced or used.

Summing up the above, the special analyses which I am presenting for your consideration to be used for all fall-seeded crops are as follows:

For sandy soils: 2-10-6; for loam: 2-10-4; for clay: 2-12-2 or 2-12-0. I believe that these four analyses, with 16% acid phosphate for those farms where manure is produced over summer and applied to fall-seeded crops, furnish the range of choice needed for these crops on any farm in the State of Connecticut.

Corn Must Mature Before Frost.

When we get to spring planted crops, we have to distinguish between the small grains, corn, potatoes, and the vegetable crops. The corn crop, for instance, must grow very rapidly or it is almost sure to be caught by the first frosts of early fall. A few days' difference in growth saved by pushing the crop along rapidly when it is still in its early stages and also ripening it up quickly and certainly at a later date in its growing period, often makes the difference between a crop of soft corn and a crop of hard corn. The great essential is to have available nitrogen and available phosphoric acid present in the soil when the first sprouts appear, as well as a large amount of phosphoric acid right through the season of growth, so that the crop may ripen up without question. For potash, once again the statement just made holds true, the sandier the soil and the smaller the manure pile, the greater need for potash; while the more clayey the soil and the larger the manure pile, the less the need for this element.

For corn I suggest that we use a 3-10-6 for sandy soil; a 3-10-4 for loamy soil and a 3-10-2 for clayey soil. Occasionally, where fair quantities of manure are applied, 2-12-0 can be used instead of these analyses; and when large quantities of well-kept manure are used, we may even depend on 16% acid phosphate.

It may be that some of you will raise a question regarding the foregoing. I have myself raised many questions. I believe, however, that the analyses suggested will certainly grow corn, and grow it at a lower cost per bushel of crop than any other treatment which can be suggested.

Keep Sloping Hillsides in Grass.

Another group of analyses is designed to be of help in overcoming one of the most pressing of the fertility problems of Connecticut,—that of maintenance of fertility on her sloping side hills. Many of these fields are in grass, and have been in grass for the past twenty years. I believe they should stay in grass. To rotate these lands is waste—a waste of good horse flesh, of tools, of time and trouble on the part of the operator, and of the soil itself, if the work is done at seasons when erosion is to be feared.

I believe that the agriculture of the future in Connecticut will confine rotation to the bottom lands and to the level hilltops, and will keep the side hills permanently in grass, but in good grass. This may be done, and most profitably by the use of top-dressing fertilizers. The analyses which we recommend for top-dressing grass lands are three in number; 7-8-6 for sandy soils; 7-8-3 for loamy soils, and 7-8-0 for those where the manure supply is large, or for soils with so much clay as to raise a question as to the necessity for potash. These fertilizers will grow grass. The two which contain potash—if selection is made on the basis of the soil and its nature—will maintain yield on our sloping side hills for years at a stretch. The manure made from the extra hay produced will go far toward keeping our plowed lands in good condition, and maintaining the supply of humus in these soils. Furthermore, if in the State of Connecticut demand could be concentrated on a few top-dressing analyses, such as these, it would aid the manufacturers in putting out cheaper plant food, with advantage to all concerned.

Our Pasture Lands our most Serious Fertility Problem.

After all, it is our pasture lands which are our most serious fertility problem. Years back they were among the greatest assets of the state. Today they are liabilities. The gross value of the product will hardly pay the cost of keeping the fences in repair. Of course fifty or one hundred years from now we may be able to get wood or timber from some of these lands, but meat, milk and wool for present use is certainly more to the point.

One reason why pastures run down is lack of plant food. Weeds come in because they require less in the way of plant food, and hence can make growth where clovers and bluegrass cannot. The remedy is to apply the necessary plant food in such forms and quantities as may be needed for the most profitable production.

A white clover pasture is far better than just a grass pasture. Milk production is largely increased, and probably at the lowest possible cost. The fertility problem of our pastures is to so treat them as to bring in white clovers, even though it be at the expense of the grasses.

Now, let me ask you a question: Who of us here in Connecticut has ever seen a real white clover pasture? Probably some of you have back in the years past, but very few young people remember the time when pastures grew white clover; yet, it is a fact that if the right kind of fertilizer be applied white clover will come in, even on the roughest hill sides, provided, of course, that the soil is moist enough to bring the fertilizer applied into full activity.

I remember a very marked illustration of this at the Massachusetts Experiment Station, where part of a pasture was fertilized with materials containing lime, phosphoric acid and potash. Within less than a year after treatment we noticed that white clovers were even invading the clumps of moss—"nigger heads" we used to call them—which I had always believed would never rot. The clovers drove out the sedges, overcame the bluets, smothered out the mosses and very shortly made a most beautiful pasture. In fact, at the end of the season, the mixed grasses, weeds and sedges on the unfertilized plot in the pasture were six to eight inches high, and absolutely uncropped. The fertilizer portion, however, had been cropped down close, showing that cattle recognize the pasture quality when they see it.

Perhaps this gives an indication as to how fertilizer helps keep down weeds. The moment clover is put in, cattle go for it, crop it down close, and in the process keep down many weeds which otherwise are well-nigh insurmountable obstacles to the success of the pasture.

For fertilizing the pasture I am going to suggest four analyses; the first of which contains 10 per cent. of available phosphoric acid and 8 per cent. of potash, and which we call an 0-10-8; the second of which is 0-12-4; the third 0-12-2, and the fourth 16 per cent. acid phosphate. On the sandier soils, especially in sections where clover is not usually grown because of the difficulty in getting a stand, I suggest the first of these—the 0-10-8. Naturally, at the present price of potash, we cannot afford to purchase it—but the time is coming when we in

America will have cheaper potash. If, however, you are fertilizing a clay pasture on the bottom lands, I am inclined to favor the 0-12-2 or 16 per cent acid phosphate.

I have frequently been asked under just what conditions I would suggest the fertilizing of pasture, just how far gone may a pasture be and still be "brought back" by the use of fertilizer. I don't know that I can give a better answer than this—that until such time as the pasture is overgrown with woody perrenials, hardhack, sweet fern, bayberry and the like—the use of fertilizer will tend very strongly towards bringing it back into a productive condition.

Fertilizers for Potatoes and Other Vegetables.

For vegetable growing we recommend two different series of fertilizers, one medium in ammonia, the other high in ammonia. In addition to this we have two special analyses which are especially useful under conditions of intensive culture.

A group of fertilizers which analyize 3-10-6, 3-10-4, 3-10-2 are suggested for use where crops are grown under semi-field conditions, as late beets, sweet corn for the cannery, tomatoes for the cannery, as it happens not often grown in Connecticut, and similar crops. This furnishes a fair amount of nitrogen, but not so much as to materially increase the cost of the fertilizer. The second group is for crops which grow more luxuriently, or those grown to reach the early market. These are 4-10-6, 4-10-4, 4-10-2. In all probability this last series is by far the best fertilizer for such crops as cabbage, cauliflower, brussels sprouts and the like. Under intensive market gardening conditions, where quick growth must be had and where the earliest markets must be reached—a 5-8-7 fertilizer is added to our list of standard and analyses. This is especially desirable on the sandy lands typical of such forms of agriculture.

For potatoes also this 5-8-7 fertilizer is good, especially where they are grown on the sandier soils. On the heavier soils a 4-8-6 and 4-8-4 can be used. You will notice, however, that we are recommending no potato fertilizer with less than four per cent. of potash. Experience of the past two years indicates very strongly that at least this amount is worth while in the fertilizer for potatoes.

I cannot discuss more at length just at this time. In closing let me simply say that if these so-called standard analyses could be officially adopted to the extent that fertilizer consumers would order from this list, and would not make demands for the one thousand and one different grades of other fertilizers, some of which are not materially different from those which we have just discussed, it can have but two results: First, to materially simplify the fertilizer problem; secondly, to make it possible for the fertilizer industry to furnish you as fertilizer consumers, with cheaper, better and more economical plant food.

POTATO GROWING AND MARKETING

By Earle Dilatush, President New Jersey Potato Growers' Association.

At this time when the cost of growing potatoes is so very high, much time can profitably be given to the crop before it is put into the ground.

Let us first consider the seed question, probably the biggest and most important of all. To begin with, we get the best seed. Those of us who buy seed north of here I believe can profitably buy certified seed. When we speak of certified seed we do not mean that we always get perfect seed. Yet I do believe that certified seed is good insurance, and will generally prove better than the common or commercial variety. To illustrate, two years ago a neighbor of mine planted ten acres of Green Mountain variety, five with certified and five with seed bought from a local merchant. The certified seed cost twenty-five cents per bushel more than the other. The yield of potatoes with certified seed was two hundred and fifty bushel to the acre, and with the other seed one hundred and fifty. Potatoes that year brought one dollar a bushel, so you can readily see that that man lost by not planting certified seed. My own experience the last three or four years has proven that certified seed almost invariably proves to be the safest and most profitable.

We are beginning to think in New Jersey that the local home grown croppers, the second croppers, make the best seed. These late croppers are dug in the fall before they are ripe. We believe in a few years we shall be able to buy our own seed in the state, which will be more profitable for us, and I am not sure that growers in Connecticut will not soon be able to buy their seed from New Jersey. Those potatoes are very small; the smallest of them seem to be best. This year I placed an order with a grocer for his culls, and really had to pay a higher price than for his large size.

We find too, that the keeping of seed demands some attention at this time of year. We buy our seed in the fall and store it in an underground cellar. We have a cellar eighty feet long, twenty feet wide and ten feet high, and we keep our seed there at a temperature of thirty-six or thirty-seven degrees. This winter it has been higher than that. We store in large bins, never larger than six by fifteen feet, and never more than a barrel high. I believe that many growers make a mistake in piling seed in bulk too high in their cellars; the main reason for this is lack of room. Potatoes stored that way and in a hot room show long sprouts in the spring. I believe that seed has been harmed more by heat than it would be by frost. Our seed is taken out of the cellar six weeks or more before it is planted. It is put in a large building on the farm, with lots of windows and plenty of sunlight. It is put about six inches deep on the floor. There is a large stove in the middle of the room, so if the weather is too cold we have some heat. These potatoes do not form large sprouts, but little stubbed sprouts as big as the end of your little finger. It is very hard to take a potato out of the cellar and know whether that potato is diseased or not. By putting them in this building and having the seed sprout we can tell. When we come to a potato with a weak sprout we throw it away. We discard about two bushels out of fifteen on an average. The seed is cut in bushel crates or slat baskets, and a handful of sulphur thrown over it. Two days afterwards it is dumped from one crate or basket into another, in order that the seed may dry more evenly. About the fifth day we dump it again, and on the sixth, seventh or eighth day those cut potatoes are taken back again into the damp, cool cellar. There we keep them from a week to a month without any harm. That seed is kept in the damp cellar until we are ready to put it into the ground.

I like to see the planting of the potatoes myself, and if the planting is in the field I feel it more necessary to be there. After we have taken all that trouble with the seed, we are also very careful with the cut seed when it is taken out to the fields. We take them out in crates and put them in the fields, and always cover them with sacks, so that the bright sunlight and the drying winds are kept away, because the sunlight and the winds sometimes harm the seed a lot before it is put in the ground.

In preparing the ground we plow deeply, about nine inches. We do not have the stones in my section that you have here. Our ground is quite level. Years ago we only plowed five or six inches, but we went down half an inch deeper every year until now it is nine inches. Having plowed the ground deeply, we take a lot of care in working the ground up. Then a spring tooth harrow on wheels goes out into the field and is put down so we break up the land almost as deeply as we plow. It pulls a little hard. Then we follow with a disk harrow. The disk harrow used to be the first instrument used, but we found it didn't get as deep as we wished; we use it now for the second operation and it breaks the ground up nicely, although the disks do not go down over four inches. Following the disk harrow used to be the first instrument used. but we found scraper. After having gone over the ground with these implements we usually have an almost perfect seed bed.

Ahead of the planter we use a fertilizer distributor. We used to always put the fertilizer on with the same implements as we planted with, but now we like our fertilizer way down in the ground. When the machine has passed the ground is almost level again. The fertilizer is put on in a wider ribbon than with a planter. We use the Robbins planter, a two-man machine, one man driving and one man sitting behind. The last two years we have used eighteen hundred or two thousand pounds of 4-8-3 fertilizer to the acre. I might say that for several years we have been making tests in regard to the amount of fertilizer, running anywhere from one thousand to three thousand pounds. Fouteen hundred pounds yielded two hundred fifteen bushels; sixteen hundred pounds yielded two hundred fifty bushels; and eighteen hundred pounds two hundred seventy-five bushels. We find that an increase in the amount of fertilizer will always bring an increase in the yield. but after we put on the amounts above stated the percentage of profit is very small.

Now in regard to fertilizer, we find that it is absolutely necessary for us to use some potash. At the beginning of the war most of us dropped the use of potash entirely, that is three years ago, and saw very little result. The fertilizer made with no potash gave almost as good results as that made with ten per cent, but the second year we found some loss. Apparently we did not need to use ten per cent. but we must use some. Last year three per cent. brought an average yield of over two hundred seventy-five bushels, no potash one hundred twenty-five bushels, and five per cent. brought a yield of over three hundred bushels. In the future we believe we shall not use less than five per cent.

In regard to cover crops, I believe they are the best paying proposition that we work on at home. We grow potatoes year after year on the same ground. In growing thirty acres, for instance, one field, the very best field I have, has been in potatoes fourteen times the last sixteen years. Now that probably is not the best way to grow potatoes, but in order to grow them year after year on the same land we use a cover crop. We use one-half bushel of rye to the acre, six quarts of vetch, six quarts of mixed clovers and two ounces of turnip seed. That mixture costs considerable money. Some people use rye alone, some rye and vetch and some rye and alfalfa; but I like the mixture because we always get something. I have not failed in a cover crop for the last ten years. Almost every year the vetch grows and also the rye, so we always have a good heavy cover crop. We use a table turnip. We grow turnips because they seem to bring more potash than anything else we can grow in a cover crop. The cost is a little over ten dollars an acre, but it pays immensely. The cover crops seem to call for a heavy dressing of manure every year. We find that a good heavy dressing of manure on top of the cover crop, and then about eighteen hundred pounds of fertilizer will surely bring a big crop of potatoes every year. A strip left through the field without manure or a cover crop has always proved to yield less potatoes than when we had the cover crop.

More than half of the potatoes in New Jersey are marketed by being sold direct to dealers at the loading stations. We happen to have railroads through the largest producing sections in New Jersey, and at these stations are one to ten buyers every year in the big potato sections who do nothing else but buy potatoes. More than half of the potatoes are sold through them and by agents, but the tendency now is more for the farmer to sell direct to the consumer. The last few years there have been many co-operative groups that are proving very satisfactory. It seems to be growing immensely in New Jersey, the grouping together of farmers for mutual benefit, and I think it is one of the greatest things I know of. Personally, during the last two years I have sold my crop together with nine other men.

We formed a group called the "Mercer County Potato Association." We hire a manager and we keep in close connection with each other. We are selling our potatoes in a manner that pleases us a whole lot. We hire as good a man as we can get and give him free rein. We simply hire a manager and tell him we put our faith in him as long as everything goes right. We have a power grader at the station. We simply put them on a conveyer that takes them to the grader, and they are put on the cars and sold practically the same day. The system is working very well for us, and I think the same would be true of any co-operative group buying or selling in this country. The first consideration is quality. We have good potatoes, and we keep the quality the best we can. I think the mistake that is made by the individual farmer and by groups of farmers in our state, and perhaps here, is that they forget to keep the quality up. We have made a success primarily because that quality has been kept up, and that quality has been kept up through strict supervision.

Grading in New Jersey is looked on very favorably. We would not have had the standard grades if the Government had not forced them upon us. The Government no longer enforces it, but we personally, and many of the New Jersey growers will continue whether the Government backs it up or not. Last year there was more opposition to grading in New Jersey than in any other state in the Union, but most of the growers before the end of the year were grading, because they wanted to.

Does it pay to cut the seed ahead?

It pays us immensely to cut the seed ahead, if it is properly kept. I hate to urge people to cut ahead, because we have to be so very careful in regard to the keeping of that seed.

Do you use land plaster?

We use sulphur. It is rather bad for the eyes, but we have used it for many years with very satisfactory results. That is the universal practice in my part of New Jersey. In Monmouth County they use dust taken from the roads, but we don't like that. We find that dust taken from the roads causes a lot of wear on the machines and is not as satisfactory as plaster of sulphur.

Why do you use a distributor?

The R. & H. planter does not put the fertilizer on any wider than six inches. We like to have it on ten inches, and we can do it with a distributor. There are several distributors. The R. & H. people put one out. We use a Eureka.

How deep do you plant your potatoes?

Not over two inches or an inch and a half deep. When the top is all harrowed down the potatoes will not be found to be over an inch in the ground. When they are put too deep in the ground they come up slowly in the spring, and they never seem to quite catch up with the potato that has been planted near the top of the ground. That may not be true of your condition.

How long are your potatoes in coming up?

That varies with the weather. If it is cold they are much slower in coming up. About two weeks after planting they usually begin to show.

What do you use to kill bugs?

We have not had to apply any chemicals to kill bugs for two years on our farm. I still have some arsenate of lead left which I bought two years ago. We believe, however, that the coming year we shall spray. We still use bordeaux and arsenate of lead, and we will use tobacco solution, a pressure of about three hundred pounds with an engine driven by power. We expect to spray about ten times the coming year.

Does it make any difference whether the pieces of potato are uniform in size?

We have found that a good piece of potato will bring the best yield. We use fifteen bushel of seed in planting an acre. We grade the potatoes before cutting, so that the large pieces are together, and the little fellows are together. The large pieces will mature just as quickly as the smaller, and will always bring a better yield.

How late can you sow a cover crop?

I have sowed a cover crop in New Jersey as late as the 20th of November, sowing nothing but rye. I should think in this state it could be sowed as late as the middle of October very satisfactorily.

What grader do you use?

The Balch Grader is used in New Jersey exclusively.

Do you change the seed every year?

Two years ago we used seed from the North, with a yield of two hundred seventy-five bushels per acre; two acres planted with home seed yielded eighty bushel. We do not plant our own seed. We find it very unsatisfactory. The trouble with our seed is that it matures in hot weather. Potatoes which mature in heat I do not believe will make good seed anywhere in the United States. The reason we like our local, late crop potatoes is that they are grown during the late fall and do not mature. This second crop is grown after the first crop is taken off, so we call them "late croppers." We do not like our potatoes to get ripe. Sometimes that reduces the yield fifty per cent. The last state of growth of a potato produces a large percentage of starch, and that starch seems to be no good at all so far as the seed proposition is concerned.

What kind of seed do they use for late croppers?

Many bring that seed down from New York and Maine, keep it in cold storage, then bring it out one week before planting and put it in a room. There are some very good growers in New Jersey who have grown their own late croppers year after year.

What size are the potatoes when you cut them?

We hesitate to cut a potato until it is quite large. If you plant little fellows, eight bushels or possibly seven will plant an acre.

NEW ENGLAND'S OPPORTUNITIES IN AGRICULTURE

By President C. L. Beach, Connecticut Agricultural College, Storrs, Conn.

Even before the war it was recognized that the world's *food* supply was not keeping pace with increase in population. During the past four years the Allied Countries—Great Britain, France, Italy and the United States assembled an army of from twenty-five to fifty million soldiers, and the Central Powers an equal number, one-third of whom were withdrawn from the cultivation of the soil resulting in a marked decrease in food production.

It was said in 1914 that the war could not last three months or at the most six months. Many theories of financiers and economists regarding the wastage and exhaustion attending war on the grand scale with which this one was undertaken have been found to be erroneous. The one axiom upon the art of war, as coined by Napoleon, however, has been found to be true. "An army moves upon its belly and deprived of food man cannot fight."

In modern warfare the Government mobilized not only an army and navy (the fighting edge of the sword) but the civil population as well. All resources of a country are mobilized and every man and every woman is called upon to devote their energies to some activity essential to the prosecution of the war. While it is true the *soldiers* in the armies of the Allied Nations and Central Powers did not suffer from lack of food, the second line of defense (the civil population) were rationed in each of the countries at war and in neutral countries as well. The end came suddenly, not as the result of a decisive battle in the field; not from a lack of soldiers or munitions; not from a lack of financial support, but from the pinch of hunger and deprivation which finally broke the *morale* of the civil population of the Central Powers and forced the military authorities to plead for a cessation of hostilities and the signing of an armistice.

How near the Allies came to losing the war from lack of food is not fully realized. There were times when the situation on the firing line was of less concern than the conditions on the bread line. Food was so scarce among the Allies that Lord Rhondda, the British Food Comptroller, cabled Mr. Hoover—"Unless you are able to send the Allies 75,000,000 bushel of wheat over and above what you have exported up to January 1, 1918, in addition to the exportable surplus from Canada, I cannot take the responsibility of assuring our people that there will be food enough to win the war." Seventy-five million bushel of wheat was the minimum amount needed to save the Allies from surrender through hunger. At that time there was not one bushel of exportable *surplus* in the country. To meet the situation attending the scarcity of food, governments attempted to stimulate increased production by means of education as to better methods of tillage, through a patriotic appeal to the farmers to cultivate more land, and by a guarantee of a minimum price for wheat and other food products. At the same time, consumers were urged to prevent waste, and instruction was given in the methods of canning and preserving foods and in the use of substitutes for wheat. In the European countries consumption was limited to minimum amounts of certain foods and controlled by the issuance of food cards.

England.

Early in the war England fixed the minimum price of wheat, oats, barley and other farm products for a period of three years and sufficiently above pre-war prices to stimulate production. A minimum price was set for farm labor. Women were engaged to cultivate the soil and six hundred thousand volunteered for labor on farms. The Government purchased tractors, operative night and day. Under the direction of town committees two million four hundred thousand acres of grass land were turned over and sown to wheat.

England increased her production of breadstuffs forty per cent. or stated in another way, the reports for the harvest of 1918 indicate that in the matter of breadstuffs, she could supply herself forty weeks in the year as against ten weeks in 1916.

Great Britain maintained her herds of cattle and number of horses, increased her sheep and made small losses in hogs,—

	1914	1917
Cattle	12,184,000	12,382,000
Hogs	Decrease of	900,000
Horses	2,237,000	2,190,000
Sheep	Increased in number	

If the war had continued another year England would have become self-sustaining except for the item of sugar. In reciting these agricultural statistics it should be borne in mind that during four years the British fleet kept the seas open for the merchant ships of the world; convoyed eighty per cent. of the transports carrying the American Army from the United States to France; mobilized, munitioned and maintained an army of seven million on the battle front and suffered a loss of one million men killed in action and totally disabled. This record is characteristic of the Englishman, who, with his back to the wall, fights on and knows no such word as fail.

France

France has been the battle ground of the war and her agriculture has suffered accordingly. More than any other of the Allied Nations she was fighting to defend her homes and firesides. One in five of her total population was under arms.

Food products decreased sharply and especially in sugar beets. Pre-war productions eight hundred thousand tons, of which six hundred thousand tons were consumed or thirty-four pounds per capita. This was reduced to two hundred and fifty thousand tons or thirteen pounds per capita.

All live stock declined during the war, the number in 1917 being thirty per cent. less than in 1913. France has maintained her young cattle, however suffering a loss of four per cent. in 1917 over 1913; her loss in sheep is most serious, while there was a sharp decline in hogs. Sufficient supplies of breeding stock remain to permit rapid replacement after the war,—

	1913		1917	
Cattle	14,787,000	to	12,445,000	16%
Sheep	16,000,000	to	10,000,000	40%
Hogs	7,000,000	to	4,000,000	40%
Horses	3,000,000	to	2,000,000	50%

Italy.

In Italy there has been some reduction of the cultivated area, but except for wheat the reduction in volume of breadstuffs had not been serious. The production of wheat was one hundred and fifty-seven million bushels in 1918 as compared with one hundred and sixty-nine million bushels in 1914, a decrease of ten per cent.

Cattle have decreased from seven million head to six million head in four years. Owing to restrictions as to the slaughtering the number of young cattle has increased from one million six hundred thousand to one million eight hundred thousand. Sheep have increased since 1908, and the number at present is about the same as in 1914 (11,000,000) Hogs have greatly decreased.

Our Allies never self-sustaining are far less able to support themselves than they were before the war began. A considerable area in France and Belgium is a devastated battlefield and cannot be made productive for a number of years at least. Women, children, old men, disabled soldiers and prisoners of war have been doing all the farming in warring nations. The soil unskillfully handled, the shortage of fertilizers, and the uncontrolled growth of weeds has resulted in a decrease in yield per acre. England, France, Italy and Belgium will need to import meats, fats, dairy products and concentrated feeds for animals. Some importation of live stock for breeding purposes may be made but for the most part the needs are for live stock products. The preservation of young stock gives promise of an early restoration of beef and dairy herds, and the general opinion of farmers is that their native stock is best adapted to their purposes.

In addition to live stock products our Allies will need to import wheat, fertilizers, wool and cotton and farm machinery. All countries have made progress in the use of farm machinery and especially in the use of the tractor.

The conditions in Germany, Russia, Roumania, Austria and other wheat producing countries are so unknown and so uncertain that no predictions can be made as to the influence of these countries on production and markets.

From all information available the opinion of the commission is that the disorganization of industry, including agriculture in the principal wheat producing countries of Europe, is so great that several years must elapse before normal production conditions are restored. One thing seems assured. All countries involved in war will at once become increased consumers when governmental restrictions upon food are relaxed. The general situation from the standpoint of the American farmer would appear for a reasonable period to be both promising and hopeful.

Last year, according to the report of the food administrator, America sent eleven million, eight hundred and twenty thousand tons of food stuffs across the Atlantic. Our pledge this year is twenty million tons. This amount of food in the form of wheat is equivalent to six hundred and sixty-six million bushels or two-thirds of the entire crop of the United States in 1918. To produce the food to fill this pledge in the form of wheat would take the entire crop of a farm in size sixteen times the area of Connecticut. If the pledge is filled fifty per cent. in wheat and fifty per cent. in the form of animal products, the area of this farm would need to be increased by one-half and embrace an area of twenty-four times the size of this state.

The American farmer has not received the Croix de Guerre or been cited for extraordinary bravery, but in spite of the scarcity of farm labor he has done his bit as a "soldier of the soil" in making the world safe for democracy and the future historian will record the acknowledgement of a grateful nation. Now that the war is over, the army of munition workers will return to peaceful pursuits; the army of occupation will be demobilized; but the soldier of the soil must remain at his post and redouble his efforts. The world will not be safe for democracy until famine, the forerunner and breeder of Bolshevism is appeased. The American farmer will not be permitted to relax his activities until the worlds' food reserves are restored to normal conditions.

As has been said, the outlook for the American farmer is both promising and hopeful and it is particularly so for the New England farmer. Not only is farming to be profitable in the immediate future but permanently as a long time proposition. Dean Henry of Wisconsin, who has traveled widely in this country and who has been a close student and keen observer of soils, farm values and markets, finally came to Connecticut and purchased a farm on which to make a home and a livlihood for himself and his son. The old adage "Go West young man and grow up with the country" needs to be restated—"Go East young man and take advantage of her agricultural opportunities."

New England has a population of six million people and an area of forty million acres, or six acres to each person, and produces food products sufficient to supply our tables for not to exceed four months' consumption. New England agriculture must be developed. The banker, the manufacturer, the railroad manager, business men, boards of trade, the educator, are of one opinion in this matter, that agriculture must be developed if New England is to retain her supremacy in trade and manufactures. Farm husbandry must progress step by step with the industries that are dependent upon it for food and raiment. The country is calling for men as loudly as the city, for men with brains, who can conserve, even enrich the soil, men who can double the production of our dairy cattle, farmers who can develop herds of beef cattle, flocks of sheep and swine where none now exist.

New England should be made self-sustaining. Six acres of land can be made to produce if scientifically cultivated, the food for one person per year and two if necessary, instead of four months as at present. With one acre area per capita, Belgium was practically self-sustaining before the war. This is the problem which you young men are born to solve. This is the meaning of our agricultural education and extension service—to inaugurate a scientific agriculture, to grapple the rural problem, to direct her development. The highway from the college to the farm has heretofore been frequented by few, but this pathway offers to young men today a business competency, a congenial atmosphere and an opportunity for service.

OPPORTUNITIES IN NEW ENGLAND AGRICULTURE

By J. L. Hills, Dean, College of Agriculture, University of Vermont.

Let us discuss to-night the opportunities offered in New England agriculture, the chances which are ours in this goodly land. Handicaps exist; but that's another story. To-night let us view matters with the eye of the optimist.

New England is bounded geographically by Canada, the Atlantic Ocean, Long Island Sound and New York. These political boundaries are fixed and determined. Her agricultural opportunities are also encompassed but not geographically, not in so fixed a way. Her agricultural boundaries are elastic and capable of expansion. They are bounded, as I see it, by her soil, topography and climate; by her cropping systems and her farm management methods; by her markets; by farm environmental conditions; and finally, by the limitations of her human resources.

I. Soil, topography and climate.

New England's soil is of a different sort than that found in many other sections. A glacial soil, other things being equal, is apt to be stronger than is a non-glaciated soil. The prehistoric glaciers which formerly covered what we now know as New England, acting like great mills of the gods, sorted. modified, pulverized rocks and soils, made them fine here and more fertile there, robbed Peter often to pay Paul. As a result, we find a great variety of soil types, fitted to many purposes; tobacco lands, onion lands, thinly clad hillsides adapted to forestry, grass clad pastures which spell milk; specialized soils which imply specialized products and favorable monetary returns. Many of her farms are poorly tilled. We hear much of exhausted soils and abandoned farms. It is often very doubtful whether a given farm is as exhausted as its farmer; whether. as a matter of fact, the soils are not tired, rather than exhausted. Exhaustion implies "emptyness, entire removal, greatly to reduce strength or energy; to deprive entirely of essential properties," whereas to be tired implies "weariness, fatigue, but not complete exhaustion." Our New England soils have often been abused, but they may be renovated.

New England's topography is largely a result of glaciation. As a result boulders have dropped, mountains rounded, valleys dug, ponds, lakes and rivers constructed. Her irregular topography of course does not lend itself to agriculture but her water falls and water powers—inheritances of the glacial epoch —imply towns and cities and these imply markets. Hence it is that the very irregularity of the topography which directly hinders agricultural operations indirectly aids them.

Climatic conditions naturally are controlling factors. The great American forage crop, Indian corn, can not be raised successfully in some sections of northern New England. while in others, only the smaller varieties can be grown. Her latitude limits the extent of outdoor feeding, but her ample rainfalls help to make good pastures and to grow fine grasses.

However, New England is handicapped on the whole as to her climate, as compared with some other regions, and we may as well pass onwards to matters concerning which we may be more optimistic.

II. Cropping systems and farm management methods.

New England's great "hold" is the special crop—milk, vegetables, fruit, tobacco and the like. Under normal conditions, she cannot compete with broad western areas in corn production. Vermont, for example, ordinarily grows one thousand acres of wheat. In 1918, responding to the patriotic urge, she grew nearly fifteen thousand, and now, despite the government's guaranteed high price, our farmers are finding difficulty in marketing the crop because of lack of storage and grinding facilities. To quite an extent it is being fed out. Under normal conditions, we cannot afford to grow wheat. It is an open question whether many of us can afford to grow beef or, in a large way pork, in competition with the West. Her animal crop opportunities seem to lie especially along the lines of dairy products, including milk, certified milk, pasteurized milk, cream, butter, cheese, ice cream and the like.

Then there is the market gardening business, the glass culture which has expanded so tremendously of late years. To be sure, southern competition is always to be reckoned with by the greenhouse man. Cuba and the drained Everglades, not to speak of the lands ranging from Norfolk southwards, favored by rapid express transportation, are competitors in our New England markets. Still, market gardening is often a profitable industry.

Then New England is a place wherein hay is grown to advantage. I am mindful of the great success made by George M. Clark, of Higganum, whose magnificently clad meadows sang loud the praise of thorough soil culture. I am mindful furthermore, that all over New England alfalfa is now growing successfully.

And then there is the fruit crop. Hood River, North Yakima and Wenatchee grow good looking apples, but the New England raised Spies, McIntosh and other splendid varieties can give these Western fruits cards and spades and win out so far as taste is concerned. Within a few miles of this hall are the famous peach orchards of the late J. H. Hale. On many New England hillsides apples, peaches, and small fruits can be grown to perfection. It is a crime that Western products should be able to compete in these Eastern markets.

And then there is forestry. One naturally thinks of forestry as a long time proposition, that when he plants trees the investment is made for his children and his grandchildren. This need not be so. To cite a single instance within my own observation, one of my former associates in 1904 planted several acres of relatively waste land to white pine. He was a middle-aged, married man, without children. He planted it as an investment, looking forward of course thirty or more years. However, six years later he was called to the Middle West. He had no difficulty whatsoever in selling his plantation at a sum which repaid him with large interest. Modern forestry looks not only towards the future, but is an opportunity of today. Forestry holdings—be they a few years or many years old—have definite cash values.

And then there are the many animal crops—cattle, sheep, swine and poultry. There are great opportunities there. In the first place, one should remember Proverbs XXVII-23. There is no record to indicate that the Babcock test or the poultry culling demonstrator were found in Solomon's day, but that ancient monarch had the right idea when he urged the Israelitish dairymen to be "diligent to know the state of (their) flocks and look well to (their) herds." This implies careful observation, the weeding out of the drones. In this insurance city, it is entirely proper to urge the breeder to insure both crop and animal. You will ask, perhaps, how one can insure a crop, a cow, a hen. If one insures crops in the fields as well as in the barn against fire, i. e. excessive summer heat, by the use of inter-tillage and, perhaps, irrigation, he may harvest an opportunity. If he insures his oat crop against smut by the use of formaldehyde; his potatoes against blight or beetle by spraying with bordeaux and arsenate of lead; his cattle against tuberculosis by taking advantage of accredited herd system; his hogs against cholera by their immunization; his hens against that dire disease, white diarrhoea, by careful inspection: his flocks and his herds by careful culling, using the Babcock test and the weight of milk with the cows, and the suggestions of the extension service with the hens, thus protecting himself against animal burglars; if he takes out all these insurance policies, his outcome is far more likely to be a successful one than if he proceeds in haphazard fashion. Those opportunities are his if he will embrace them.

And then there are various other specialties. I know of farms given over to quite an extent to the growing of frogs' legs. There are one or two skunk farms up our way and at least one fox farm. One of our Vermont counties is largely given over to the growth of beans. We are developing in some sections, primarily in the Aroostook region, the seed potato business. There are specialists in cheeses, in sausages, in melons. There are farmers who are making a specialty of growing youngsters for the dairy. Then there are the tobacco and onion lands of the Connecticut Valley. There are many such opportunities, and when one remembers that seventy years ago Massachusetts raised roughly three-fourths of all the food products she consumed, whereas to-day she raises less than ten per cent., it would seem as if there was room for more food production in New England.

In this connection, however, one should remember that there is a certain obligation which one owes to the farm and to posterity. Time was when the soil might be robbed by its owner and he could ask who should say him nay. Time is coming when society will deny the right of a man, even though he own his farm in fee simple, to rob the soil, to denude it of plant food, to hand it down to the next generation in poorer condition than he received it. Any cropping system which is adopted should, as its foundation stone, consider the maintenance of soil fertility.

As for farm management, I may say that the account book and the study of the cost of production has come to the front rapidly during the last few years. The modern farmer now is able as never before to know his business from A to Z; where he succeeds financially and where he loses; to gauge his selling prices by the measure of his definite knowledge of the cost of production; to know how to change his methods in the interest of an increased income. He joins such co-operative associations as the New York Milk Producers' League or the New England Milk Producers' Association. He is less patient than he was at one time with the "thirty-five cent dollar;" and, as a result of the study of the whole proposition, some farmers are planning to a greater or less extent to reorganize their farming operations; to systematize; to remodel buildings, to re-layout their lands; to plan their cropping systems to better advantage; to consider the advisability of drainage; to increase machine usage and decrease hand labor, because of its shortage and of city competition; and, finally, to attempt to plan the labor distribution throughout the year with a view of avoiding labor peaks.

Consumers have been enjoying too cheap food in bygone years. Cheap government lands, the grazing of public lands, the relatively plentiful supply of farm labor, working twelve to sixteen hours a day, soil mining processes, etc., have resulted in cheap food. The situation is now utterly changed and we cannot again expect low prices. Furthermore, the proportion of producers to non-producers has profoundly changed. When George Washington ruled this land it was nine to one; now it is one in three. It is only because of the lowered cost of unit production that one can feed two.

III. Markets.

The United States contains six per cent. of the population of the world and seven per cent. of its area; but its supply of many of life's necessities goes far beyond its proportion of population and area. For instance, seventy per cent. of the copper, sixty-five per cent. of the oil, seventy-five per cent. of the corn, sixty per cent. of the cotton, thirty-three per cent. of the silver, fifty-two per cent. of the coal, forty per cent. of the iron and steel, twenty per cent. of the gold and eighty-five per cent. of the automobiles are of American origin. And, significantly, a very large proportion of the wealth represented by these figures is centered in the North Atlantic States. This fact gives our farmers unequalled markets. No other section of the United States is so densely urban as is Southern New England. The importance of this unique opportunity can not be overestimated. New England's roads, railways and trolley lines promote rapid transportation. Motor trucks and autos speed in all directions. The refrigerator car is in a way a menace to our local farming interests, but on the whole ease and rapidity of transportation are favorable factors.

Among her advantages should be stated the many co-operative buying and selling organizations located in her midst. This advantage of course is not peculiar to New England. Her farmers are conservative and do not always work in close harmony with their neighbors, but increasingly they are becoming accustomed to pooling their issues and to buy and sell—the latter is the more important of the two—more or less in unison.

Then there is the opportunity for advertising along the road side, on the delivery cart, in the newspapers. Farmers need to do more than they do to "magnify (their) calling." I well remember the effective newspaper advertisement by one of my dairyman friends, which read somewhat as follows: "My herd is kept for profit. My twenty-four cows averaged me last year one hundred fourteen dollars gross and sixty-seven dollars net income. I have two bull calves for sale from cows of this sort. Who wants them?" Advertising co-operatively is worth thinking about. Neither singly nor collectively do farmers tell of their wares to the consumer as much as they should.

And there is another opportunity upon which too much stress cannot be laid, and that is the opportunity to fight Bolshevism. A year ago this time this world of ours was closer to hunger than it had been for hundreds of years. We are now asked to send twenty millions of tons of food "over there." There is a measure now before Congress which contemplates a one hundred million dollar appropriation for food. The proposition is just this, as I understand it; Bolshevism is made up of one-third reaction against autocracy, one-third illiteracy and one-third empty stomach. We can fight Bolshevism much better with bullets of bread than with bullets of lead. This land has an obligation and an opportunity to meet this challenge and to fire these bread bullets. If we are to export twenty million tons of food, the bulk of it must come from the West and South; and that means that we in the East must feed mouths which otherwise the West would feed.

IV. Environmental Conditions.

Among New England's agricultural assets may be mentioned the educational, social and religious opportunities of the open country.

1. Schools are found everywhere and colleges are plentiful. Compare this situation with that existing on the wide prairies and remember how much more there is to life than meat and to the body than raiment. The best legacy one may leave his children is not necessarily a well-stocked farm, but a well-stocked mind.

2. Among the social privileges which are ours may be mentioned the omnipresent Grange, to belong to which is both a privilege and an opportunity; the County Farm Bureaus, with their men and women agents, various demonstration projects and club activities; the Farmers' Clubs, which have sprung up in so many communities. These serve to bring people together. It is noticeable of late years as compared with the situation obtaining twenty years ago that the farmer is less individualistic, less self-centered, less "sot," that he is more gregarious, more openminded. I have sometimes been accustomed to say that to my mind, seven men—and two of them Vermonters—have helped amazingly to lessen the isolation of farm life and to improve its opportunities. These men are—I loyally put the Vermonters to the front—T. N. Vail, who typifies the rural telephone, a boon to the socially inclined farm housewife and to the commercially inclined husband; Justin S. Morrill, the father of the agricultural colleges of the land, from whose fertile brain sprang the idea which has fructified every state, county, town and hamlet within our borders, bringing agricultural education, research and extension to our very doors; William Saunders of Washington, father of the Grange, which, like "good wine needs no bush;" Seaman A. Knapp of Iowa, the father of county agent work in the South, whence it has spread the country over; Henry Ford of Michigan, whose product is met on every roadway and seen in almost every farmyard, who has greatly increased the ability of the farmer and his family to get about the world; S. M. Babcock of Wisconsin, the inventor of the Babcock test which placed co-oper-

ative dairying upon the industrial map, which lifted from the shoulders of the farm women the drudgery of the home handling of milk; and, finally, Uncle Sam, who, in the garb of the R. F. D. mail carrier, keeps the farm home in close touch with the world at large. All of these men and the things they stand for have been important social factors in the improvement of the farm conditions the country over. One may look upon their work and say with the Psalmist: "Behold, how good and how pleasant (yes, and how profitable) a thing it is for brethern to dwell together in unity."

3. The religious environment should be stressed. I have a friend in Burlington who has a fad of collecting photographs of church spires. He owns a fine collection of photographs of New England rural ecclesiastical architecture. Now while the multiplicity of country churches lends itself to his particular foible, it does not lend itself, in my judgment, to country needs. The rural problem is, to a large extent, a scoial problem and one factor in its solution is, of course, the rural church. Morally, ethically, sociologically, it should be a factor promoting community idealism and leading in the social reorganization of country life. But how often does it fail in its mission. Its field is small, its members conservative, its "unhappy divisions" are all too apparent, often there is no resident minister, it fails to envisage its possibilities, does not really grasp its community. If, however, within its doors leadership can be developed, jealousies are forgotten and the community spirit dominates, it can become a very important factor in the increase of opportunity for New England agriculture. If competing churches federate, if the federated church can become a social center, the likelihood of the agricultural environment being improved is enhanced. If, in short, this potentially powerful agency realizes its opportunity to deal with this world as well as the next, if its members will realize that the saving of a neighbor's soul and the improvement of his wellbeing are at least as important as is saving one's own soul, the liklihood of the church functioning "one hundred per cent. efficient" is increased.

The clergyman of such a church, if he would be a community leader, should have sympathy with rural ideals and rural people, have a grasp upon rural problems and love the open country. It were well if he had some notion of agricultural affairs, of science as applied to agriculture and he should apprehend the vital social problems of country life. There is ample opportunity for constructive social service here, as much so in a way as is in the city.

4. Let us not fail in this survey of the environmental relationships to cite the important work of the extension service, the college militant, the college on wheels on its statewide campus. It was a fine conception, this recognition of the universal right to literacy. "It was a great day when the common man raised his head and said, 'I, too, will be educated.'"

I need not tell you its story. Not yet five years old as a federal enterprise, it is a lusty youngster. Those in a position to know, who speak not hastily but who weigh their words, say that to the extension service system of the Federal Department, the Colleges of Agriculture and the County Farm Bureaus, more than to any other one thing, is due the record crop of 1918. The Lord helped us; "Gott" was "mit uns" and not with the Kaiser; the farmers worked as never before; but the extension service was the ignition system. When I look back to the days of small things thirty years ago, to the slow growth twenty years, the increase during the past ten years, when I contemplate the present edifice, I look forward with confidence to the increasing effectiveness of this great agency. It offers an opportunity not peculiar to New England, but one in which New England fully shares. It is a great antidote to individualism and an effective factor in making New England agriculture prosperous.

5. The historical background of New England should not be forgotten. Is it not an advantage to me and to my children that the blood of John Alden and William Brewster flows in our veins? What Vermonter does not thrill when he remembers Ethan Allen's demand at Ticonderoga? Plymouth Rock, Bunker Hill and Boston Common are names with which to conjure, as are also Israel Putnam and Molly Stark in the days of '76; Captain James Lawrence of the Chesapeake in 1813; the Seventh Massachusetts at Baltimore in 1861, the two Vermont Admirals, Dewey and Clark of the Spanish American War; and who does not now thrill when he learns what the Twenty-

sixth Division did at Chateau Theirry, St. Mihiel and in the Argonne? Who does not lift his hat to Connecticut, the list of whose casualties seemed to me, as daily I used to look them over, was greater in proportion to the size of the State than almost any other? Surely a land that breeds such men as these is one in which it is worth while to live and work.

V. Human Resources.

Success in farming has been said to lie one-tenth in the soil and nine-tenths in the man. The human factor is to-day the limiting factor in New England. The labor supply appears to be the crux of the whole matter. What opportunities are there here? Connecticut farmers will say that "there ain't no such anamile" as good farm labor at reasonable prices. Bridgeport has broken many a Connecticut farmer's heart. However, there are really two ways of looking at everything. The pessimist says, "I never had anything I didn't lose;" the optimist says, "I never lost anything that I have not had." What is there by way of opportunity in the New England farm situation to-day? What sunshine can be extracted from this cucumber?

Farm labor as compared with city labor is in many ways unattractive. The hours are longer and wages are usually less. However, Johnny is now to come marching home again; vast numbers of men will be demobilized, some of whom will become available as farm laborers. The Federal Government through the Departments of Agriculture and of Labor is helping. Then there are the Woman's Land Army, the Boys' Working Reserve, Boys' and Girls' Clubs all of them praiseworthy and effective agencies. There seems liklihood of considerably more unemployed labor lying around loose this coming year than has been seen of late. There is increasingly noted a tendency towards the revival of the oldtime practice of changing works. But when all is said and done the inevitable trend on many New England farms will be towards simplification of business, towards increasing the proportion of machine labor and diminishing the proportion of hand labor. Tractors, milking machines, harvesters, silos, auto trucks and the like are multiplying in numbers and augmenting the power of the farm to grow crops. Grass lands will increase and tillage areas diminish. New England has been hard hit for farm labor and has not been able fully to adjust herself. Her farmers can not greatly increase production on prices which do not promise a "cost plus" outcome, and in the face of Western bumper crops and the release of shipping, are under no moral obligation, as they were in 1917 and 1918, to do their utmost. In view of the inevitable risks of crop failure, due to weather vagaries, and their recent patriotic response, who will blame them if they try to play safe? Never have I felt less certain as to what to say to farmers as to their production plans. It is time for wise counsel—I wish I were wiser—and for cool heads —I have almost cold feet this year whereas last year I hotly urged maximization. The well informed county agent, the agricultural "Johnny on the spot," in consultation with well informed farmers, is as likely as anyone I know to be in a strategic situation to work out a safe answer to the question, "What about 1919 production?"

The man should be greater than his job. How many inept, inert, under-energized, uninformed farmers are found on our New England hillsides! "The poor ye have always with you." The rising generation, better taught, agriculturally minded through school influences and home training, ought to be a great improvement on that now extant. The vast majority—perhaps nine-tenths—of our dairymen do not know the cost of what they produce or how much they produce, do not breed wisely, weed judiciously, feed carefully, or read at all. Many of them lay the blame for their relative lack of success upon the distributor. They forget the parable of the mote and the beam. How shall their numbers be made less? Vocational training in the school, extension teaching with the adults are the most serviceable prescriptions. But their very ineptness spells opportunity to those who succeed, for the supply is lessened and demand is more apt to be the under dog. However, it is duty and opportunity alike to raise them to a better condition, an opportunity which New England will not fail to grasp.

THE SOIL, ITS MAKING, MAKE-UP, MOISTURE, MICROBES, MANURING AND MANAGEMENT.

By J. L. Hills, Dean of College of Agriculture, University of Vermont.

This alliterative title at least gives one some notion as to the many-sidedness of the soil. It is no simple affair, this mother of us all, and its adequate handling is not a thing any dunce can master.Time was when the family failure was deemed fit to be a farmer; time is when all men, artisan, banker, capitalist, the whole line down to zoologist, take off their hats to him who feeds us all, realizing that his is truly a man's job.

The soil is a complex in which manifold forces play. Many sciences are involved in its study. Geology functioned in its beginnings, chemistry tells the story of its composition, physics deals with its air, heat and water contents, biology cries aloud that the soil is alive, and economics, younger sister of the sciences, teaches as to its proper conduct. Neither time nor space suffice to deal exhaustively with a subject concerning which ponderous volumes have been written. Only the barest skeletal outline can be set forth.

Soil Making.

Soil making has been going on since the earth began to take form from the void. Various forces have been at work, internal and external.

The internal forces were more active in the earlier days of the world's history than they are today. Volcanic rock readily disintegrates to form soil, crystal movements have elevated mountain chains and sunk continents, and changes in rock structure have led to increased readiness of disintegration.

The external forces have been and are the great soil makers. The air chemically aids in weathering through its oxygen and carbonic acid gas contents, particularly when these are absorbed by water. It mechanically erodes rock by wind-driven sand and builds up vast areas of dust soils. It affords opportunity for heat and cold to expand and contract rock particles, leading thus to their disruption, particularly through freezing water which, in expanding, bursts rocks asunder.

The ground water acts chemically to oxidize or rust, thus causing crumbling to de-oxidize especially in swampy areas, to hydrate and thus to burst, and to dissolve rocks, particularly limestone, gypsum, etc.

Weathering, a general term covering the effect of the air and ground water and of life activities, is an important process, the essential function of which is to loosen rock particles as a precedent to their removal by wind or water. The thickness of the soil blanket thus formed varies from nil to a great depth but rarely exceeds a hundred feet.

Water in motion is the great transformer of nature. Erosion, its great function in soil making, consists of three subprocesses; weathering, defined above; transportation, the removal of loosened or dissolved fragments to other points by wind or water; and corrasion, the wearing effect upon the river bed produced by solution or by the frictional impact of the weathered fragments in transit. The amount of material thus weathered, worn away and moved is stupendous. Erosion may be constructive, if exerted on rock to make soil, or destructive, if exerted on soil to remove it from one point to another or to the sea. The deposition of weathered and corroded material is an important matter in connection with the building up of alluvial soils. Sundry causes bring about this deposition, more particularly the retardation of the river flow. It usually occurs in valley bottoms and at the mouths of streams. The topography of the country round about and the nature of the stream are affected thereby, and mankind's welfare is bound up therein.

The continental glacier of prehistoric times swept over New England, abrading, eroding, depositing clay, sand, pebbles, stones, rounding the mountain tops and deepening the valleys, hollowing out rock basins for ponds and lakes, profoundly modifying the character of its soil and to a large degree determining its industrial character as a manufacturing rather than an agricultural section. Its handwritings are seen in every direction, and perhaps as much as or more than any other one factor it has determined the character of northern agriculture.

Plant and animal life activities are important agencies. Lichens tend to disintegrate rock structure. Sundry minute forms of both plants and animal secrete carbonate of lime or silicic acid. They tend also to disrupt and disintegrate rocks by their exudations. Sphagnum moss forms peat beds. Seed bearing plants feed animal life and through decay furnish humus. Their roots by their penetrating powers tend to open up the soil and to break rocks and by their solvent powers to dissolve minerals. Several forms of animal life functionate. Corals build reefs, mollusks form limestones, earthworms aid in the formation of vegetable mold and the increase of the soil humus, ants, particularly in tropical countries and in drier soils, act similarly, major animal life is less important in this connection, while unfortunately, man's efforts as a rule have been destructive rather than constructive.

Soil Makeup.

The soil is made up chemically of many different elements, more especially oxygen, hydrogen, carbon and nitrogen derived from the air and sodium, potassium, calcium, magnesium, iron, aluminum, chlorin, silicon, phosphorus and sulphur derived from the soil. All soils contain plenty of most of these elements and we do not need to worry about them. But at times nitrogen, phosphorus, potassium, calcium and perhaps sulphur may be relatively lacking.

Nitrogen, calcium and sometimes sulphur are quite apt to be lost in drainage waters. Soils naturally carry but little phosphorus and the grip the soil has on its potassium content is hard to sever. Hence it is that these are often in too small quantities to enable maximum crops to grow. However, crop failures may be due to many things other than lack of plant food—too poor drainage, for example. The weakest link is the measure of the chain's strength and the size of the crop is determined by the lowest factor, be that chemical, physical or biological in character.

There are many who have the notion that by means of soil analysis one may determine what ails his soil and what his crop needs.

There are several reasons why soil analysis is not helpful. In the first place it is difficult for the farmer to take a sample which means anything. The composition of soil samples taken three feet apart in the same field are often quite unlike, and the question arises which is right, if either. Then, again, inasmuch as most eastern soils, other than sodlands freshly broken, have been fertilized more or less and because a considerable proportion of the manurial constituents thus added are not used up but are unevenly distributed, other sources of error are introduced. Moreover the chemist cannot distinguish with any degree of certainty between plant food which is available this year and that which may not be available for a hundred years to come. The total content of each ingredient may be determined but not its availability. A soil may be literally loaded with plant food which the crop cannot use. Furthermore crop failures may be due to causes other than the lack of plant food; such, for instance, as soil acidity, lack of humus, inadequate tillage, faulty drainage, etc. Soil analysis may disclose a relative lack of plant food or the presence of some deleterious matter; but much further than this at present it cannot go, popular notions to the contrary notwithstanding.

How may one tell what his soil needs? A brilliant green luxuriant foliage indicates plentiful nitrogen supplies; a light green and somewhat scanty growth indicates nitrogen shortage or else an ill drained soil. Full ears and plump grain spells plenty of phosphoric acid; the reverse its lack. Successful beet or lettuce growth indicates that the soil does not need lime. Potash hunger is not as readily diagnosed as are shortages in other ingredients.

Soil Moisture.

It is probably safe to say that in at least two seasons out of five in New England, the main limiting factor in crop growth is the soil moisture supply. It may be either excessive or deficient but it does not approach ideality. A system of soil management which will tend to control this situation is worthy of consideration. Underdrainage is the best prescription in case of soils which are apt to become over-moist, and assiduous cultivation with a view of lessening the losses due to evaporation from soil surfaces, the usual treatment when drought impends. With special crops, irrigation or tenting (as with tobacco) may pay. There are many hillside springs and brooks which can be impounded for irrigation purposes. It is being done, and successfully, in some instances.

To tell the entire story of underdrainage, its principles and practice; to set forth the philosophy of tillage in its relation to moisture conservation, its whys and wherefores, hows, whens and wheres; to display the potentialities of a modest irrigation plant in southern New England; to do these things would cover more white paper than seems warranted. Special treatises are available in state and federal publications; and county agents will discuss them with anyone who may be interested.

Soil Microbes.

In Germany, it is said they are called "germs," in Paris "parasites," in Ireland "mike-robes." However named, these bacteria are minute plants, as truly such as the corn or the potato, plants of microscopic size but of teeming numbers. The figures of the war debt shrink in comparison when one attempts to enumerate the numbers in a cubic foot of soil. Their essential function is molecular simplification, which, being interpreted, means changing complicated material like flesh, manure, stubble, etc., into simple materials like water, ammonia, carbonic acid gas, etc. They are the prime agents of decay, of making organic plant food available to plant uses. There are both harmful and helpful sorts, those which serve to drive off nitrogen into the air and those which serve to prepare it for plant uses. It is now well understood that they bear a distinct relationship to nitrogen fixation by legumes, to nitrogen gathering and to the maintenance of soil fertility. The use of legumes as green manures, a well recognized practice in the days of the Caesars, is now rationally explained. One may thus materially add to the fertility of his acres by the use of bacterial cultures secured of the Federal Department of Agriculture or of commercial houses.

Soil Manuring.

Soil deficiencies are often made good by the application of manures, either natural or artificial. The former supply much more than plant food. They benefit the soil chemically, physically and biologically, supplying it with plant food, lightening and aerating it, increasing its warmth, augmenting its moisture holding capacities and furnishing to it countless numbers of bacteria as well as plenty of food for their growth. The latter supply plant food only. What to use, when to use it, how much to use, and in what manner is a local problem, to be solved in accordance with the testimony afforded by a multitude of witnesses, the soil itself, its type, its past history as to cropping, manuring, etc.; the crop and its special needs; the sources of supply, the prices asked, etc. Too much manuring is of a haphazard character; too little is based on a carefully thought out procedure. Personal experience linked with observation and supplemented by the county agent's suggestions should guide one aright.

Soil Management.

The essentials of soil management—other than manuring—may be summed in the word "Dirt;" for this word, which is not a synonym for soil—for dirt is "matter out of place," whereas soil is very much in place—is made up of the initial letters of the four great fundamentals of soil management, namely, drainage, irrigation, rotation and tillage. Here again whole volumes might be written and any attempt at epitomization were useless.

To such as desire to pursue any special line, briefly developed or hinted at in this address, the Vermont bulletins listed below are available without charge for the asking (address Experiment Station, Burlington, Vt.) so long as they are in print.

No. 143, Soil Making; No. 154, Soil Classification and Uses; 160, Limes and Liming; No. 165, Peat and Muck; No. 177, Drainage; No. 182, Irrigation; No. 190, Rotation; No. 198, Tillage; No. 206, Farm Manures; No. 207, Manufacture of Commercial Fertilizers.

THE EUROPEAN CORN BORER

Pyrausta nubilalis Hbn.

By Dr. W. E. Britton, State Entomologist, New Haven, Connecticut.

It is not as a pessimist or as an alarmist that I appear before you today. In fact, I am probably as much of an optimist as any of the speakers of the afternoon, yet I shall fail in my obligations to Connecticut if I do not emphasize the point that the European Corn Borer, now present in Eastern Massachusetts, constitutes a distinct menace to American Agriculture.

This pest was discovered in Massachusetts in 1917, and now occupies thirty-four towns, an area of about three hundred and twenty square miles, extending slightly south of Boston, a few miles westward and then towards the north and east as far as Manchester-by-the-Sea. It is not known to be in Connecticut though perhaps may now exist, or later appear within our borders. It occurs in Central and Northern Asia, Central and Southern Europe and in Egypt, where it attacks corn or maize, millet, hemp, and in Southern Russia it is reported as injuring cotton.

It is not known just how the insect was brought to Massachusetts, but perhaps it came in hemp, as there are several large cordage factories in Charlestown on the edge of the infestation.

It was my privilege to observe the destructive work of this insect, and to attend a conference of Entomologists, in Boston, September 6th, 1918. We visited a field of sweet corn probably in the town of Winchester, near the Arlington line. It was badly damaged; nearly every tassel was broken over; in the axil of every leaf there was a heap of sawdust as large as the end of my thumb; larvae were tunnelling in the main stalks, in the ears and in the stems or pedicels of the ears. I doubt if a single plant in the whole field had escaped attack, and most of the plants were badly injured. The larvae were also boring in some of the larger weeds, such as barnyard grass, lamb's quarters, red root pigweed, and dock, growing in or around the corn field.

There are two and perhaps three generations each year, the insect passing the winter as a larvae inside the corn stalks, pupating in the spring and after two weeks the adult moths appear late in May. The young larvae feed at first on the leaves, then begin to tunnel, sometimes in the midrib but often go through the unfolded leaves at the whorl and into the developing tassel stalk. As this stalk approaches its full height the tip breaks over so that a part or the whole of the tassel hangs downward. This greatly reduces the amount of pollen and therefore tends to lessen the crop. It is also the characteristic feature of the infestation, which is first noticed by the grower. As they increase in size, the larvae work downward into the larger stalks and often leave the stalk at one point and go into another node or even to another plant. Also several larvae may be working at the same time in one plant or in one portion of a plant. Excessive infestation will weaken the stalks so that they will break and fall over. At the Station exhibit in the Armory, close by, you will see a photograph of a small jar containing 311 larvae, taken from a single hill of corn. This borer may be found in any part of the corn plant except the fibrous roots.

It is the second brood of larvae, however, which appearing late in the season do the great amount of damage, which I have described. At the time of my visit to Boston, corn was the only crop known to be seriously injured, though several other vegetables growing near the corn were attacked. Late in the season, after the corn had ripened, the larvae caused serious injury to celery; in some cases eight borers were found in a stalk and 46 in a plant or at the rate of 1,006,000 per acre. There are now about 90 food plants of this insect in Massachusetts; corn, celery, millet, barnyard grass, pigeon grass. dock, burdock, beet, Swiss chard, potato, tomato, bean, spinach, dahlia, gladiolus, lamb's quarters, red root pigweed, Chrysanthemum, ragweed, lady's thumb, and common beggar's ticks.

According to European literature this insect causes damage to corn nearly every year, the percentage of loss varying from twenty-five to ninety per cent. and even reaches one hundred per cent. in certain districts in Southern Russia. Even in Europe where it has long existed, natural enemies do not hold it in check, and parasites are scarce. Mr. Stuart C. Vinal of the Massachusetts Agricultural Experiment Station at Amherst, who has investigated this insect, stated that out of six hundred larvae only fifteen or two and five-tenths per cent. were parasitized.

The adults of both sexes fly short distances but are not especially attracted to lights. The natural spread, therefore, would be rather slow, probably only a few miles each year, though greater in the direction of the prevailing winds. The chief means of spread is evidently through shipments of corn on the ear, corn stalks, celery or some other infested plants. There is great danger in shipping sweet corn but fortunately for Connecticut, the movement of this vegetable in commerce is usually toward the north, rather than in this direction. Seed corn may be shipped if it is shelled, but there is danger of transporting the larvae inside the cobs. Corn stover is not shipped extensively, but is sometimes used as a packing material for heavy pottery, glass, cut stone, etc. Perhaps the greatest danger lies in the shipment of infested celery which may be sent in any direction.

The Federal Horticultural Board has established an embargo, prohibiting the shipment of corn on the ear and corn stalks from the infested district into other states. Connecticut and Vermont have enacted similar quarantine regulations against Massachusetts, and the state of Massachusetts will soon provide a quarantine inside its own limits to prevent such shipments from the infested district to other points in the state. It is now evident that these restrictive regulations in order to be effective must be modified to stop the movement of celery.

But quarantines alone will not eradicate the pest. Spraying is of little use. Control measures must provide for the proper disposal of all corn stalks. All cobs, stubble, weeds and rubbish around the field should be burned in winter or early spring to kill the larvae in them. If corn stalks are cut into short pieces and fed green to stock, or packed in a silo, few larvae will survive. Probably few will live if the dry stalks are run through a shredder and fed to stock. But in localities where this insect is present the farmer can no longer leave his corn fodder in shocks in the field, or even stored in the barn; he cannot afford to leave the stalks uncut in the field; for these conditions are very favorable for the overwintering larvae.

Absolutely, this appears to be one of the worst pests which I have ever seen. Just think of the enormous damage sure to follow if it is allowed to reach the great corn growing region of the middle west. Surely it would not be a desirable addition to the long list of cotton pests in the South. What, then, are the prospects of extermination? A bill is now before Congress (Senate Bill 5290) appropriating five hundred thousand dollars for this purpose. It should, by all means, pass. Some of our entomologist friends at Washington favor a small appropriation for purposes of investigation, believing that we do not yet have sufficient data to warrant starting a campaign of eradication. My friends, there is danger in their point of view. While such investigations are being made with a few thousand dollars, the European Corn Borer will go on spreading and extending its borders; by the time the investigations furnish sufficient data to warrant a campaign of extermination, it may take five times as much money to wipe out the pest as it will at the present time and it may be too late to wipe it out at all. We have had too many experiences in following this policy. If your house is on fire, first put out the fire, investigate afterwards. Any desirable or necessary investigations can be made at the same time that the authorities are making a serious attempt at extermination. Extermination may not be possible. It is worth trying. The stakes are so great that a supreme effort should be made to eradicate this pest from the United States. It will take a large amount of money, but this is as nothing when compared with the loss almost certain to follow if the European Corn Borer becomes distributed over this country. Even if we find later that we have failed to exterminate this pest, we will have the satisfaction of having made the attempt; if we do not make the attempt we shall be criticised, and justly so. The time to act is *now*.

The American Association of Economic Entomologists, at its annual meeting in Baltimore, December 27, 1918, with members present from all the Eastern United States, voted unanimously in favor of a large appropriation, and an attempt to exterminate this pest.

If any farmer suspects this insect to be present in his fields, he should notify me at once. I thank you.

APHIS CONTROL.

By M. P. Zappe, Department of Entomology, Connecticut Experiment Station.

Of all the pests with which the Connecticut farmer must contend, the aphids are among the most difficult to control. Nearly all kinds of cultivated plants are more or less infested and during the last two summers the potatoes have been hard hit by them.

The potato aphid *macrosiphum Solanfolii Ashm* is commonly called "the pink and green potato aphid" because the two forms, one pink and the other green, are found together on the leaves. It is also a serious menace to tomatoes, and is often found on the following plants: eggplants, peppers, sunflowers, jimson weed, ragweed, lamb's quarters, sweet-potato, canna, hollyhock and many common garden weeds.

Life History.

This insect lives over winter as a shiny black egg, usually on rose, and with the coming of summer, hatches and flies to nearby potato fields. The females are capable of producing from three to twelve young per day. These young are all females, and in from ten days to two weeks, are full grown and begin to reproduce. The last brood of summer females, produce winged males and wingless females. These females then lay the over-wintering eggs.

Injury to Potato.

The aphids at first seem to get on the under sides of the leaves at the top of the plant, also on the blossom stalks. Later when they become more numerous they go down on the lower leaves, until the entire plant is covered with them. Then the leaves curl up, turn brown and die, if no control measures have been started. This results in checking the growth of the tubers, and in cutting down the yield. Early varieties are not so seriously damaged as are the later ones, because they are nearly mature when the infestation is at its height.

Natural Enemies.

This aphid, like most other species of aphids, is preyed upon by adults and larvae of lady beetles, and by the larvae of lacewing and Syrphid flies. These predatory insects help control this pest by eating the aphids in large numbers. There is still another, a parasite, which is quite a factor in the natural control of this pest. This is a very small four-winged fly,*Aphidius rosae Halliday*, which lays its egg inside the body of the aphid, and the tiny grub which hatches from the egg eventually kills its host. Aphids parasitized in this manner may be found dead on the upper side of leaves often with small round holes in their bodies where the parasites emerged, after reaching the adult stage.

Control.

This pest may be held in check by spraying with nicotine solutions and soap, also by the use of kerosene emulsion.

Probably the easiest and quickest to prepare and apply are the tobacco preparations sold under the names of "Black Leaf 40," "Nikoteen," and Pratt's "Nicotine." Of these the first is most commonly used in Connecticut in the following way:

"Black Leaf 40"	1 pint
Laundry Soap	2 pounds
Water	50 gallons.

The soap must be first dissolved in hot water and then added to the other ingredients. Many species of aphids are covered with waxy scales, and ordinary spray does not wet them very easily; it collects in drops and runs off. The soap being alkaline, dissolves the wax, enabling the spray to reach the body of the insect whereupon the nicotine causes its death.

Kerosene Emulsion is cheaper than the tobacco preparations and is fully as effective in killing the aphids. It is made in the following manner: Four bars of laundry soap dissolved in hot water, then add three gallons of kerosene oil and churn together until the mixture looks white and creamy. Add this to 50 gallons of water and apply to plants.

Spray Apparatus.

For small fields of potatoes a barrel pump mounted on a wagon or two wheeled cart does very well. If the pump is in good condition it will carry two lines of hose with about seventy-five to one hundred pounds pressure. In spraying for this aphid it is very important to spray from below, in order to hit the insects. Spray applied from above will kill very few of the aphids and time and material will be wasted.

Automatic four row potato sprayers as they come from the factory are not very effective against aphids, but by a little altering may be used with good results. Nozzles should be lowered and turned up at an angle so as to throw the spray on the under side of the leaves.

Apple Aphids.

There are several species of aphids which attack apple but there are only two which are of any great importance in Connecticut. The green apple aphis is found on the growing tips of the tree, particularly on the water sprouts. Its entire life is spent on the apple trees. The eggs are oval, black, shining, and are found on the twigs in the winter. They hatch just before the leaf buds open.

The other species is known as the rosy apple aphis, is larger than the green apple aphis, and is commonly of a rosy color. Its eggs occur on the twigs and hatch about the same time. Unlike the preceeding species only about three generations live on the apple, then they migrate to another food plant. The rosy apple aphis is usually found on the inner portions of the tree rather than the exterior parts and effects the development and growth of the young apples, causing them to be gnarled, small, and irregular in shape

Control.

The control for both species is the same. A delayed dormant spray (Winter Spray) lime and sulphur or miscible oil applied about the time the buds are beginning to show a little green, will hold then in check. This kills all aphids which have hatched and also kills those eggs which have not hatched. Later in the season, if they should become numerous, a spraying of "Black Leaf 40," one pint to one hundred gallons of spray will kill them, provided the leaves have not been curled too much, so that it would be almost impossible to get at them with the spray. On very young trees the branches may be bent over and dipped into a pailful of spray material.

Apple Red Bugs.

These are sucking insects which are becoming quite prevalent in Connecticut, are wingless in their early stages and of a bright red color. Their eggs are laid in lenticels in the bark, in the late summer, and hatch the following spring at the time the trees are in blossom. The young at once begin to puncture the leaves. The clusters of reddish dots caused by these punctures are quite conspicuous and are usually the first indication that the insect is present. The injury to the foliage is slight, but as soon as the young apples are formed, the bugs start to puncture them. If the fruit is attacked when very small, it becomes stunted and gnarled and never develops to a marketable size. Half grown apples become irregular with deep cavities in their sides.

When spraying for coddling moth "Black Leaf 40" may be added at the rate of one pint to one hundred gallons of water in addition to the arsenate of lead to control the coddling moth. The red bug has a curious habit of running around the opposite side of the tree from the spray, very much as a squirrel will keep on the opposite side of a tree from the hunter. This habit makes it hard to hit with spray material but if the spraying can be done by two men spraying from opposite sides of a tree at the same time and at right angles to the wind, it will not be very hard to hit them. This method of spraying will wet three sides of a tree at once and make it difficult for the red bugs to escape.

Mr. Charles R. Treat: Gentlemen: As a member of the General Committee for Farmers' Week from the State Department of Agriculture, I have been asked to open this meeting and preside. I am not a breeder, and therefore I will not attempt to make any remarks,—and I am sure will not detract at all from the value of the meeting. We have with us today two speakers who I am sure will bring you much knowledge from their great experience.

Better sires, to my mind, simply means specializing in one particular branch. Personally I am interested in plant breeding. The two are similar, only applying to different branches of agriculture. At present with the high cost of labor and materials that go into production, it is absolutely necessary for us to produce the best, putting the best that we can buy on the market into that and thus producing the very best possible, in order to make agriculture profitable.

Now the first speaker on the program for this afternoon (I will say to those who have not yet heard him in these meetings) is one of the best speakers that I have heard in a long time. Last night at the Dairymen's Banquet, Mr. McKerrow of Wisconsin, gave the members and their friends in attendance some thoughts that are well worth taking home and pondering over. I know from his talk on general subjects that he is a man of mature judgment. Now we will listen to Mr. McKerrow, and he will bring us advice from a state which is accomplishing great things, and also from his long experience.

PRACTICAL RESULTS OF PURE-BRED SIRES

By Mr. George McKerrow, of Pewaukee, Wisconsin.

Mr. Chairman and Fellow Breeders: This question of the sire to my mind is one of the most important that the live stock man of any state, district or county has to consider. When I was a ten-year old boy I remember hearing a remark that has been ringing in my head ever since,—yes, two remarks. An uncle of mine who was managing a large farm for a manufacturer here in the neighboring state of New York, brought a carload of pure-bred Merino rams to Wisconsin to sell to our sheep breeders. It was my business to take the team and drive this uncle around to the sheep farms in the county of Waukesha, Wisconsin, which at that time had some reputation as a breeding ground for Merino sheep. He visited a Scotch farmer who was interested in sheep, and a little later this Scotch farmer came over to our place to buy a ram. He was one of those Scotchmen who keep the Sabbath Day and everything else he could lay his hands on, so there was a great deal of haggling and Jewing before he bought the sire; and in following around eavesdropping I could see that this Scotchman was bound to have a certain ram in that bunch, although he examined all the others more than he did that one, and asked the price of others more than he did that one, because when he got the price of that one he remembered it. Finally my uncle said "You have a good flock of sheep, Mr. Kerr, that we visited the other day, and you should have a fine ram. You are a hard-headed Scot and you ought to buy the best ram I've got, but you love the American dollar so much I don't suppose you will put the money into it; but remember this, Mr. Kerr that 'the sire is half the herd or flock,' and that 'the best are none too good.'" I have remembered those two remarks from that day to this: "The sire is half the herd or flock;" and, "the best are none too good." When I became a young breeder I put that motto "the best are none too good" as my motto on my letterheads, and I think my sons have it there yet.

But that first saying: "the sire is half the herd or flock,"—while there is a lot of truth in it, I don't believe from my fifty years or more experience in breeding pure-bred live stock, and from my observations in my own and other countries,—I don't believe it is strictly true. That is true if the females in your herd or flock are equally as well bred and as strongly line-bred as your sire, and they will have an equal influence on the offspring. But if you are trying to improve, as every man should, no matter how high he has got his herd or flock, either grades or pure-breds,—if he is trying to improve, the only way he can improve is through the blood of that sire, and if he is trying to follow up that improvement, then the sire is always a little more than half his herd or flock, because the improvement has to come through him. If you start with a grade or scrub herd or flock, then all the improvement must come through that pure-bred sire, and I am here to say that from my experience and observation that sire, so far as improvement is concerned, is all of that herd or flock in the first cross. Now that is a strong statement, and you may question it, but you hard-headed men if you will think over and observe in your own experience and in the experience of your neighbors, and in the herds and flocks that you buy from, you will reach the same conclusion that I have,—that the sire makes all the improvement, and therefore, so far as improvement is concerned, is more than half that herd or flock. When you come to make your second cross there is a little influence brought in by your half-blood on the female side, but still your sire is much more than half,—I would figure him about three-quarters,—and I should say as you improve up, when your herd reaches a pretty high standard he is but little more than half. Yet that statement is a hard sentiment to get into the heads of the average farmer of Wisconsin.

I expect you "down-Easters" are probably a little sharper, a little quicker witted, and may catch it a little quicker than the farmers of Wisconsin that have descended from the Scandinavian and the German ancestry. You know the saying that it is pretty hard for a German to see a joke. I was once in a large Farm Institutite meeting. In the evening our lamented ex-Governor, W. D. Hoard, one of the brightest men in Wisconsin in his day, was giving an address on the "Practical Education of the Farmer," and he touched on the mixed population, and in speaking of the Germans he said the German was an industrious, steady-going citizen, and was helping in a very large way to build up the material interests of Wisconsin, and was developing intellectually about as fast as you could expect, considering his lineage. "But," he said, "a German doesn't see a joke; and I always like a man to see a joke." Old Uncle Theodore Louis, a German himself, was just passing out of the hall to make his train. The aisles were crowded and he was working his way down when the Governor made that remark, and he stopped and faced around, and said

"Governor, that is not so. A German can see a joke just so good as any other man." "Now Uncle Theodore, you just wait a minute," said the Governor, "and I'll tell you a joke, and I don't believe you will see the point as quick as the American. Down in New York State where I was raised we had an old farmer whose feet were so large that he had to go out to the forks of the roads and use it as a bootjack to pull his boots off." The people laughed, but Uncle Theodore didn't laugh. "There," the Governor said, "the others saw the joke; you didn't." "But Governor," said Uncle Theodore, "that's no joke; it's a tamn lie." Now the German may be a little hard to convince that the sire is even half the herd or flock.

I know a very thrifty German farmer, with only seventeen children in his family. He makes it a point as soon as a son gets married to buy a farm and make the first payment on it, then he leaves him to root out. When a daughter marries he does the same thing, holding her and the son-in-law to root out. But he is very conservative. He hung onto his old herd of cattle; he had a grade sire for a good many years. But he attended some of our Waukesha County sales,—some of his boys had waked up more than he and were insisting on his buying a pure-bred sire,—and he had priced some of them, but they were all too high. But the boys got him to attend one of the sales, and there was a second-day sale of grade cows, and when he saw those grade Guernsey cows selling for $150., $175. and $200., and one two-year-old heifer, exceptionally good, $200., the old gentleman came over to me and said "What you tink,—that it pay me to buy one of those Guernsey bulls and raise heifers that sell for $150.? All they offer for my heifer at home is $90. or $100. Will it pay me?" "Sure it will pay you," I said. "Well, that's what Charley tell me. I guess I have to buy." It took two days to convince him, but now he is selling heifers at $150. and cows from $200. to $250.

The practical Scotch farmer I mentioned bought finally the ram he wanted, one of the choice rams of the bunch,—but he did manage to squeeze some $20. from the price of $200. or $300.,—and he took him down to his flock, but the next season he lost him. Some three or four years later I was talking with the man, and he told me he had lost the ram, but he had one crop of his lambs, something like one hundred lambs. I was condoling with him on the loss of so much money, but he said "I didn't lose anything. The lambs sheared one and one-half pounds more of wool than the lambs from any other sire, and wool was seventy-six cents a pound. Now that didn't exactly pay the price of the sire, but when his daughters produced they were the best shearers in my flock. So now the dead sire doesn't owe me anything, and I think your uncle was right when he said 'the sire is half the herd or flock.'"

The pure-bred bull campaign is one of the most valuable things being pushed ahead by the county agents over the United States,—one of the things we have to thank our Department of Agriculture and our State Agricultural Colleges for pushing. Individual breeders and breeders' associations and our Farmers' Institutes were pushing it for years, and probably accomplished a good deal, but now these departments are pushing it harder than ever.

I happen to live in a county that showed up the leading county in our state in the use of pure-bred sires, fifty-eight per cent. of the herds in Waukesha County, Wisconsin, being headed by pure-bred sires, not entirely due to the pushing of county agents and organized associations. They brought us buyers who appreciate. But the reasoning of my old German friend that the produce of a scrub cow from a pure-bred sire was worth fifty to sixty per cent. more than from the grade sire,—that is the convincing argument. What will it bring? Then in these grade herds, when the daughters began to produce they produced ten to fifty per cent. more than the daughters of the grade sires produced,—and that is the reason nearly sixty per cent. of the herds in our county are headed by pure-bred sires. Yes, by this time I think sixty-five per cent. are headed by pure-bred sires.

I have talked with many of the men, the later converts to this idea, who are just beginning to milk their grade heifers, and I haven't yet met the man who hasn't said when the question was put to him "Has it paid?" "Yes, fifty per cent.;" "one hundred per cent." some of them say; and I have that evidence back of me when I say, "If you are not using pure-bred sires, make haste and get them."

But there is a difference in pure-bred sires. I am sorry to say we have pure-bred scrubs, and pure-bred scrubs with good pedigrees too, if you will just stick to the paper, without looking up sires and dams and family records, and sometimes if you look them up they are very good; but when you see the individual there is something lacking. I don't want to use a sire, no matter what his pedigree, if he doesn't show some individuality,—and the more the better. For that matter I don't want to hire a man that drags his feet behind him when he comes for the job,—but of course they don't come for the job now. We have to go after them. I used to rely a good deal on my wife's judgment. If she saw a man coming up the lane carrying his little grip, and his feet were dragging, she would say "That fellow either was over-worked in his last place, or else he hasn't any life in him. You'd better go slow on him." Of course it is a good thing to have a good wife, and I have that kind. A gentleman from Canada once said in introducing me that he had been at our farms,—"You know him pretty well and I guess you think pretty well of him; but I want to tell you that he has some sons that are smarter than he; but I have been at their home, and I know the reason,—he has a wife smarter than he is." When I arose I said "I have to plead guilty, but there is one thing I want you to understand,—I selected that wife."

Now back of this sire I like to see a good dam, and then a good grandam. Of course I want to see a good sire and a good grandsire; but if I bank specially on either side it is on the dam side. We built up a family of sheep in one of the leading breeds that probably stands at the front in America of that particular breed, and we built it by knowing what the dams and the grandams and the sires and the grandsires were. First, in Great Britain in buying the foundations for that particular family, and second, in our own flocks, for we have made a private record along the family lines and we know what they are; and while we can't breed along those lines with precision,—we don't know exactly what we are going to get,—we know pretty near, and the blanks in that family line are very, very few.

But in the sire, I say, I want strength, masculinity and type. I want the right kind of head. The leading English breeders, the men who made those great breeds that we have now in the United States of America, and which are going from Great Britain to South America at long prices, are the men who take a good look at the head of the sire they are buying. The width between the eyes and the ears, that indicates there is room for brains; and strong, muscular jaws that indicate masticating machinery that can grind up food; rather a wide head showing strength back of it by a strong-muscled neck, which to my mind means prepotency,—the ability to sire the same kind. A large heart girth in our dairy animal made largely by depth, in our beef animal by width; a big barrel; and then a conformation showing the purpose you want him for. If it is for beef of course you want a wide shoulder and a full shoulder to put on the meat; a wide loin, and the width carried well out to the tail to make a uniform carcass. But with the dairy animal, instead of that wide shoulder to lay meat on is rather preferred a smoother shoulder, more of a race horse wither type. Now I don't know but this has been carried to an extreme in our dairy judging. We want a well sprung rib, not too wide at the shoulder, but you do want a wide loin and a strong back, and we want the width carried out back to the tail just as we do in the beef animal, but we don't want it loaded up with flesh in the same way. We don't want the full round, the heavy, meaty round, because we want room there for an udder, and if you have the full round it shows that Nature has closed up the place for an udder, and knows what she is doing, because she has left no room for an udder. So we want freeness from meatiness there, and we want loose, pendulous skin with well placed teats, indicating that when the udder develops it will fill up the space. That is, of course, on the heifer; but on the sire we want indications of the same thing,—rudimentaries instead,—well placed and good size, not too deep in the flank line, and yet deep enough to leave a pretty good conformation. We want a deep chest, a deep heart girth, deep abdomen for ability to handle food. We want a large, bright, bold vigorous eye, but an eye that indicates mildness of temperament.

Now dairy sires differ in temperament, largely due to the way in which they have been handled in their original homes. I often go to the Channel Islands,—go to Guernsey and Alderney,—and as we go around looking at their sires, very seldom do we see one that shows any remonstrance at the coming of a stranger or even notices him. But on the Island of Jersey it is different. Half of the sires you see curve the back and switch the tail when a stranger comes around. That is considered a good qualification,—nervous temperament; but the Guernseyman takes a different view, probably for a different reason. He wants a bright eye and a quick, elastic step, but he says "We don't want him fiery or rattle-brained, because the women take care of our cows in Guernsey, and we don't want the women to be troubled by an excitable sire." When I was on the Island of Guernsey I wanted to see the bull that had just won the Grand Championship. I went to the farm with a friend, and the owner was there, and we asked him to show us this particular bull. He seemed unwilling, but finally he did take us out, and he cautioned us and said "He is a bit nervous since the Show and we will go in quietly." When we came out I said "What is the price on him?" But he would set no price; he was not for sale. Then he called my friend to one side and said "It's too bad, but the bull is to be killed tomorrow morning. He got a little wild at the Show." "What," I said to my friend, "a magnificent bull like that, richly bred,—why doesn't he keep him himself and use him?" "No," he said, "no one would use him on the Island; we don't want that temperament. We don't breed that way." I offered to buy him at a price and take the chance on him. But no, he wouldn't sell to anybody. He was too conscientious. Over in Jersey they think a little nervousness is a good thing, because it means nervous energy,—more butterfat. So there is a difference between breeds, and these things have all been considered by the men who have developed these leading breeds with animals of all kinds.

But to go back to the pure-bred sire, it would be worth billions to these United States of America if we could inculcate that idea into the heads of our stock men, men who are raising stock throughout this country,—that the sire is at least half the herd or flock,—and that to get improvement they must depend upon what has been produced by blood line work, by pure breeding. And with that idea, just as fast as these pure-bred males can be secured they should be put at the heads of all the herds in the United States. I say it would mean millions, yes, billions; but at the same time a rush of that kind for pure-bred sires would induce many of our breeders to keep every male and offer him on the market, and in one sense that would be a detriment. There are a good many pure-bred animals sold today that get out and head grade herds, scrub herds, that are scrub individuals, and they don't give the results that they ought to give. They are like some men, they ought to die younger, and the younger they die the more credit they are to the race. And as breeders, we should cull; no matter how good the herd or flock you have built up, there are going to be culls. Reversion is one of the principles it is hard for the breeder with his best skill to overcome, and all of us, I suppose, if we trace our family tree back far enough will find some black sheep. Yes, there is reversion, and these animals that show reversion should never be put at the head of a pure-bred herd. Sometimes they will do fairly well with a grade herd.

Now if you can afford to pay $500 for a sire, you can afford to pay $50, yes $100, to go and look at him and his family relatives. I tell my boys that when they get ready to marry not only to look over the girl, but look at the family relationship; but I don't suppose they will pay much attention to it. That is what you ought to do. If it will pay you to buy a good sire, it will pay you to spend a little money to look him up.

Now you may differ from me. You may be like the old German farmer who jumped up in the audience and said "I don't believe what you say," but if you don't, I see my friend Rawl here, and I will give him the opportunity of helping me out. I am simply talking from the practical standpoint, from my observation in our district, in our country and in Great Britain and from my own experience, and I am here to say that if you are in a position to buy a pure-bred sire, by all means do so. As I said yesterday, the fellows I would like to talk to are not here. I wish they were. They are the fellows who think they know it all, about breeding, feeding and everything else. But let me say this thing,—that when you sell a pure-bred sire to any of these neighbors that know it all, just try to get it into their head that the feed cross is just as important as the breed cross. No herd or flock can be bred up to a high standard of excellence without you feed and feed intelligently.

'Discussion.

Q. How far can you go without ruining your pure-breds when you keep breeding in?

Mr. McKerrow: That raises a question. Now line breeding and inbreeding are similar and yet a little different. In building up a family, for the first cross you can closely inbreed provided that your sire is of that very vigorous type, showing vitality at every point, and good conformation at every point, and his daughters also show vitality and good conformation, not showing any prominent family weakness. You can of course breed safely, but if there is any family weakness standing out in sire or daughters, than don't inbreed sire to daughter. But in the other case, if there is unusual vigor and perfection, you are pretty safe. We have produced some of the best sires, in our flocks especially, by breeding the sire to the daughter. After that, beware! You can build up the family by taking relatives further out, cousins, uncles, aunts, etc., but always keep in mind that there must be vigor, there must be no prominent fault in any part of their make-up, and particularly in those things that indicate life, vigor and strong vigorous constitutions.

I had a long talk with a Mr. Webb in England, whose father perfected the Southdown sheep. I never met the father, because he was dead before I made my trips, but Mr. Webb told me that one of the things that the father had tried to impress upon his sons,—when they did their inbreeding to be certain there was no family defect standing out; then they were fairly safe. But there are apt to be some defects. Perfection, you know, in animals, is a good deal like perfection in the human family,—hard to get, and there may be some defects. A good judge can see it when others wouldn't detect it at all. Mr. Webb said sometimes they would take the risk a little because they were exceptionally strong in some way and they wanted to perfect the line, but from one-half to two-thirds of the time that defect would grow into a big one. So that shows that inbreeding is a dangerous thing for people who do not understand it, and it has been the best thing in the world to men who do understand it.

Q. I would like to ask Mr. McKerrow what his idea would be in this case: I have at home five generations, including the bull, grand dam and great-grand dam. Could I use him on his half-sister that went back to the old sire?

Mr. McKerrow: In regard to your half-brother and half-sister, where everything is right that should bring you good average results,—if everything is right. I would say go experimentally into breeding the sire produced by that half-brother and half-sister. If his sons and daughters produced well, and if it proved all right in vigor and conformation, then go ahead, for then you would get a strong family line. They would be double grand-daughters. But there is a point even in the building up of a family, where we don't want to go too far. Then the out cross comes in. In selecting a sire for out crossing, keep just as near to the family in type, conformation, production,—everything of the kind that you can, not only in the sire you select, but in his individuality. Go carefully on that. Then you can re-establish your line breeding with the diluted blood of the outcross. It is a big problem.

IMPORTANCE OF BETTER BREEDING

By B. H. Rawl, Assistant Chief, Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C.

This better-sires movement is so tremendous that it is puzzling to know where to take hold of it. When we analyze such results as Mr. McKerrow has been giving us,—results that can be had from almost every section of the country, results that come from every phase of animal breeding,—I say when we realize what good breeding means as compared to the ordinary breeding we have in America today, it is hard to understand and to account for our present status. Now I am not speaking in an attitude of criticism of the American farmer, because I have found that the American farmer generally has good sense, and a great deal of what we hear in denunciation of farmers' practices is more or less unfounded. Circumstances exist that we do not take into consideration.

Yet I cannot understand why a man who is going to keep animals, and is going to do the work necessary to care for them, would just as soon have an animal worth one hundred as two hundred dollars. This pure-bred sire campaign is important, just because it is important to realize the difference between one hundred and two hundred dollars. That reason alone justifies a strong national movement to encourage the use of this potential force,—and that is what good breeding means. If you had a waterfall near here, as you have, and if you had factories along the banks of these streams, as you have, and you persisted in hauling coal in to do the work that the water will do, what would you say about it? What would your community say about it? What would everybody say about it? They would say "it is unsound business; we have water going over that fall and it will probably be going over there next week, next year and next century, and we might just as well use it and cut down the cost of manufacturing our product, and take advantage of a potential force."

HEREDITY AS A POTENTIAL FORCE. Now heredity properly handled is a similar potential force. A dairy sire that will increase by ten or twenty-five per cent. the productive capacity of his daughters, and will hand down to future generations this increased productivity, represents to my mind a potential force similar to the water running over that fall. Isn't that sound reason?

It seems to me, therefore, that no one can question the wisdom of using better sires. I hesitate a little to offer more examples showing their influences, but there are a few in my possession here that are so significant that I must take a little time to give them to you. They are the result of definite activities, and it is only through the use of such complete and comprehensive results that we can put on this great movement.

What is needed is that every farmer in the country be brought to realize the potential value of good breeding, fall in line with the movement, and do the best he can. Here I want to add this word. I think that those of us who have been engaged in breeding better stuff have indulged in talk that sometimes confuses the average farmer. We led him to believe that breeding good animals requires a great deal of profound wisdom; while in reality the difference in knowledge possessed by the most successful breeder we have and the poorest one is not so very great.

We do not have such a tremendous quantity of knowledge about breeding; and yet we have enough to make the success that Mr. McKerrow has been talking about. It takes a lot of common sense; but it is not the thing that the average fellow cannot do, if he falls in line with the established methods that have been successful. Take the bull club, I don't say that every man in the neighborhood who owns a cow could apply the principles Mr. McKerrow has been talking about; but you and I know that when the people come together and form a bull club, and secure the aid of the State and Federal agricultural workers who are dealing with that matter and are in position to give aid, it becomes relatively simple.

Bull Clubs are Succeeding.

Bull clubs are being organized in all sorts of communities, and they are succeeding in all sorts of communities. I will give you a few examples. I know you can get them from your own immediate localities, but there are so many million dollars of potential wealth going to waste that I can't help throwing in a little more evidence, with the idea that it might help to make such work understood.

Typical Results of Cow-Testing Work.

In the Department we get records from bull clubs and cow-testing associations, and I am going to quote just a few. We have an annual record of a scrub cow producing one hundred and forty-six pounds of butterfat; her daughter from a scrub bull produced one hundred and twenty-six pounds butterfat; and her granddaughter from another scrub bull ninety-nine pounds butterfat. That fellow is getting rich so fast that I am sure he doesn't know what to do with his money. We get facts like those from the cow-testing associations.

Then as to the bull club. Mr. McKerrow says scrub bulls are just like scrub folks. That is natural because they are always associated with each other. We were talking about the bull clubs. You know we have only seventy-nine in the United States, and I am sure we ought to have seventy-nine hundred. I will give you the results of three different bulls in one association. Six daughters sired by bull No. 1 produced in a year seven hundred and twelve pounds more milk than their dams and thirty-nine pounds more fat. That is an average. Five daughters of bull No. 2 averaged one thousand pounds of milk per cow more than the dams, and their butterfat production averaged fifty-five pounds more. Six daughters of bull No. 3 averaged one thousand six hundred and ninety-five pounds more milk than the dams, and ninety-three pounds more fat. The average of these seventeen daughters, sired by different bulls, is one thousand one hundred and forty-four pounds more milk and sixty-three pounds more fat than the average production of their dams. Does that mean anything compared with the other fellow who had the dam that produced one hundred and forty-six pounds, and one hundred and twenty-nine pound daunghter and the ninety-nine pound granddaughter?

A Farm where Fat Production was Trebled.

I am going to give you figures from one farm out in North Dakota. That is a relatively undeveloped dairy region, you know, but let's see what they are doing. In 1910 the farm had an average of one hundred and thirty-one pounds of butterfat for the herd of seventeen cows; in 1911 the same number of cows averaged one hundred and forty pounds; and in 1912 they averaged one hundred eighty-nine pounds of fat. In 1913 the herd contained sixteen cows, which averaged two hundred pounds fat. In 1914 ten cows averaged two hundred and forty-two pounds fat. In 1915 thirteen cows produced on an average two hundred and ninety-one pounds fat; and in 1916 fourteen cows averaged four hundred and twenty-seven pounds fat. In six years the butterfat production had more than trebled. In this community the farmers are all working together. They haven't all been so successful as this one; I am giving you the best one. But what does this mean to you? What have the dairymen of New England, of Connecticut, your neighbors, you—what have you done? Have you herds in which the cows average four hundred and twenty-seven pounds of fat? Yes! a few, but not many; yet it can be done in six years' time. It can't be done every time, but every one who knows how to take good care of cattle, and who owns bulls that are good enough can do it. What applies to dairy cattle applies to sheep—to horses—to hogs—and to beef cattle. It doesn't always apply in just the same way, but the fundamental principles are the same.

Better Stock Adds to Interest of the Business.

There are a lot of interesting results of that sort that I could give you; I want to mention one more. Do you ever have any one come around to your place, cattle buyers, say, looking for a carload of scrub dairy cattle? What he will say is, "I want a carload of high-grade cows," or "I want a carload of purebreds." There is a little psychology associated with breeding good animals that is perfectly wonderful. Show me a man with good pure-bred cattle,—I mean pure-bred in the sense that he is keeping up the records and is really handling the business intelligently,—and I will show you a man who is taking care of his milk, who is interested in the development of the community, and who takes better care of his family.

When one of these bull associations is organized with twenty, thirty or fifty small farmers, even family-one-cow-farmers, and later when they have some high-grade cows some one asks one of the members "Is this a registered cow?" It will probably be "Well no, but she's pretty good." He is a little ashamed that she is not registered, and very soon is likely to own a registered cow. Even the family cow is more interesting if she is pure-bred. Incidentally she eats no more hay, she eats no more grain than does the ordinary scrub cow. She is worth two, three, four or five times as much.

I am wondering if any of you have buyers coming along asking for scrubs. If the market is demanding scrubs, I say breed scrubs; keep supplying the market. If the market is not asking for scrubs but higher grades and is paying higher prices for them, is it not the logical thing to supply what you can sell to best advantage? Is it not what you Connecticut people do with corn, apples and potatoes? There are a lot more reasons for keeping good pure-bred sires, but I have given enough, —particularly when I do not want to think any are necessary.

Improved Stock Benefits Entire Community.

Now about the How of this thing? How are we going to get the dairymen in Connecticut convinced of this,—convinced of the wisdom of improved breeding? How are we to convince all the hog men, the poultry men and the sheep men? How are we going to get this better-sire campaign over? Well, in the first place, whose business is it that it should go over?

We are sometimes in the habit of thinking too much of farm activities as purely a class activity. We think about the farmers' breeding activities as something solely of use to the farmers. We think about making appropriations for agricultural purposes, and our representatives talk about what has been done for the American farmer. Well, I do not quite get that point. It looks to me like the development of agriculture is good for every one. Let us just take a single vicinity. Suppose you have in the vicinity of your town here a thousand head of cattle. Suppose with a very, very small cost the value of that thousand head of cattle can be increased twice or three times. Whom does that benefit? Well, it benefits first, the man who produces the cattle, but it benefits second, the man who does business with the cattle raiser. Is it not true that almost every one does some business with the farmer? Why does your city give away a lot here for a manufacturing establishment when there is a possibility of bringing here a certain number of laborers and a certain amount of money from month to month? This is justified by increased business. But that money doesn't go to the banker and the merchant. It goes to the factory and the employees. Yes! but it doesn't stay there long. It soon goes to the bank, to the merchant, to the lawyer, to the school, etc. You have simply brought in so much more money to the community.

If you add $100 or $200 to the value of your animals, isn't it a comparable case? You are bringing there another class of animals that day after day produce thirty, fifty, sixty per cent. more. Now is the bank interested in it? Does the bank work to increase value? Could you turn loose $100,000, $200,000 or $1,000,000 in this community and have the bank share nothing in the benefit? Could you have the merchant not share in the benefit? What sort of a merchant would he be? What sort of a school, what sort of a law office, what sort of a town would it be? Why, gentlemen, this thing is just as plain to me as can be.

More Business and Bank Deposits.

There were three hundred or four hundred dairy cows in a certain community where the Department of Agriculture developed a creamery four or five years ago. Today that community is supplying to this factory the milk of over three thousand cows. Last year those farmers received approximately four hundred thousand dollars for their dairy products. Today they have already between two and three hundred purebred dams in that neighborhood.

I was talking with one of the bankers there a few days ago. I said "How much have your deposits increased since that factory has been here?" He said "Seven hundred thousand dollars." I said "How much of that is due to the dairy development?" "Well," he replied, "about three hundred thousand dollars. I have a great many new farm accounts."

This was the man who had financed the buying of the cattle, and he had bought and paid for a good many of the two hundred and forty or two hundred and fifty pure-bred cattle. And what is to be said about his city,—about every man in that town? It is this: You can't turn loose four hundred thousand dollars in a farming community and not have the people generally benefit.

Butter—Principally Sunshine.

Now gentlemen, bankers are beginning to realize that when you take the air, sunlight and soil and mix a little skill with them and make money out of them, that it is not going to hurt anybody. That is what agriculture does. What is a pound of butter? It is principally sunshine. You take hold of the sunshine and make it valuable. Therefore I ask you whose business is it? Is it the farmer's business alone? It is the farmer's of course, but it is the banker's also; it is the merchant's, it is the teacher's, it is the community's business to build up something that is constantly wealth-producing and constantly adds to the usefulness of the community as a place to live and a place to profit. Is that fair? Does any one feel that it is an exaggeration? I wish I could say this to the business men,—how are we going to get the bankers, the merchants, and all that machinery back of a movement so vital to the nation?

This is the question we must face, and I believe that this is not alone a question to be considered in an agricultural meeting. That banker that I mentioned, although he has had little contact with agricultural finance until within the past five or six years, is being consulted all over this country today because of his experience in financing an enterprise that has added a half million dollars' income to his community in a few years. The bankers are interested in it; this man was invited not long ago by a committee of the large bankers to talk to them about it. They are susceptible to it, but they don't know how to hitch up this pure-bred sire proposition with the question of deposits.

The banker often thinks of farming, I believe, somewhat different from business. That is all wrong. We have lived all through that day. Farming must be associated with banking just as manufacturing and merchandising are. We must realize this and the banker must realize it.

A Movement Worthy of Hearty Support.

Now I come to you with the question earnestly seeking to know how it is possible to reach these people, to reach the people of the country, of your state, of the other states, to put the question across. Can we go to our homes and talk this matter over? Do you believe it yourself? Is it "bunk" or is it good sense? If it is "bunk," forget it. If it is good sense go home to your neighbor, your banker, your school teacher, your merchant, and tell about it, urge it, and above everything, do it yourself. Let us push the better sires movement. Let us make this movement so well understood that a man will be ashamed *not* to have a pure-bred sire certificate displayed on his farm. I am sure you can't have a man that is a great success in breeding and a great failure in other things. We don't work that way. We are not good men in the house and liars out of doors. We are honest in both places, or we are dishonest in both places. When a man hangs back too long on the question of breeding, or recognizing these fundamental economic facts, he makes me think he is a hanger-back on other things as well. Now I feel keenly on this matter,—the great significance it bears to agricultural development and economic development generally.

I ask too that we not forget this,—when a public appropriation is made to a great fundamental thing in agriculture, it is for the public welfare. Don't let us think that this is simply going to make farmers rich and everybody else poor. When we put in efficient breeding it is going to stimulate breeding and increase production, and this is sure to bring down the cost of the product. Now, gentlemen, this question therefore. is not something handed out for the farmer, that is for him and for him alone. It is for public good, it is for efficiency in the production of essentials for the nation, and we need to keep the matter very clearly in mind.

When you eliminate tuberculosis here in your state you save the efficiency of a great many cattle. Do you think the public is going to receive no benefit from that? Every time you save an animal from tuberculosis you keep that animal to produce. and so long as you do that you are adding to the milk supply of the country. I don't believe you need to lie awake at night thinking you are robbing the public to help the farmers. The accomplishment of these great semi-public movements,—the reduction of hog cholera, the reduction of this tremendously burdensome scrub which is worse than tuberculosis,—the reduction of these things is necessary to maintain efficiency in supplying the nation's needs.

Now gentlemen, if you have not done it already, get in the better-sire movement. Take this blank and fill it out. There is nothing here to go to the tax collector, to get you to put the value on anything. It is simply a movement of national significance that has been developed to increase the interest in better sires. Then take that card that is given you by the Department of Agriculture and put it on your premises. Let every one that goes by see that you are a member of the organization which is attempting to eradicate the scrub sire.

Discussion.

Question: Are they running milk campaigns in the various states to stimulate the consumption of milk?

Mr. Rawl: I believe we have a national movement under way to tell the people what milk means; to educate the people so that they will drink up all the milk that is produced.

Mr. McKerrow: I would like to say a word about the milk campaign. We have had a little of it in the Middle West, and it has been bringing some fruit. Yes, I know it has, because Colonel Gustave Pabst of the Pabst Brewing Company after paying twenty thousand dollars for Holstein cattle said that as the country had stopped him brewing the amber fluid that had made Milwaukee famous (or infamous), the next best drink he could furnish the people was Holstein milk, and therefore he was putting his money into Holstein cattle. So you see the consumption of milk is increasing.

Mr. Daniels: I think I stated yesterday that there are about six thousand five hundred bulls in the State of Connecticut, and there is an opportunity for eight-five per cent. more pure-bred bulls to be installed before we have our state insured against the scrub sires. I believe the place to get this bull association established is where the people don't think it is policy for them each one to keep a bull,—where there is only two or three cows in a herd. I hope this talk we have had today will be more thoroughly considered in the years to come than it has been in the past. There has been an increase, by the way,—we find there is five per cent. increase of pure-bred bulls over last year. That is, this year fifteen per cent. of the bulls in the State of

Connecticut are pure-bred, against ten per cent. last year.

Mr. McKerrow: There is one thing I want to mention that came to my attention a year ago. In one of the counties that had forty-five per cent. of pure-bred bulls in its herds a breeder got up in a meeting and suggested that he would exchange a pure-bred calf from his herd for a scrub bull that any farmer was going to turn off, and a farmer took him up. It became a movement in that region, every breeder agreeing to exchange a pure-bred calf for a half-grown scrub bull; and they sold the scrub bull for veal. They tell me that association has been the means of placing pure-bred bulls in that county.

Mr. Hough: That is being done in Litchfield County in this state.

Mr. Daniels: That is evidence that lots of people have more than enough. I remember last summer I was passing a neighbor's yard and I saw a calf that he was intending to raise for a bull. It was probably three months old. It was in pretty good condition for veal and possibly worth thirty or thirty-five dollars. I had a beautiful bull calf that I didn't feel I could spare the milk for maintaining, and I proposed to this neighbor that he take this young calf of me that was a week old, and give me his calf. He said "Well, I've got this calf pretty well started, and I think I had better keep it." I hope there will be something done that will get into the newspapers, or the inner conscience of those men some way, so that they will begin to realize that a pure-bred sire is a necessary adjunct to a farm. It is a difficult thing for us to place our pure-bred calves.

Mr. Rawl: I want to mention that it is rather frequent that in a block where a bull association is started the scrub bulls from that whole block are sold for enough to buy the pure-bred bull for the entire block.

Mr. Treat: In most of these meetings I see a great many familiar faces of men who are well versed in the subject under discussion. There may be one on an average from fifteen towns. He may have left five hundred townsmen at home who are sick with this disease, and they are the men some one of you want to get this information back to. Do you not find this your general experience in the United States, Mr. Rawl?

Mr. Rawl: It applies to every county in the United States.

SUGGESTIONS WITH REGARD TO ORCHARD FERTILIZERS AND THEIR USE.

By Dr. E. H. Jenkins, Director, Connecticut Experiment Stations.

What I have to say is not in the nature of a formal paper but of some rather disconnected notes about fertilizers and their use in orchards. The question of fertilizing orchards is never fully answered, even for a single soil and climate, but in looking over the addresses which have been printed in your proceedings for the last ten years there seems to be little which has been left unsaid.

The question is not alone one of the kind and quantity of plant food which shall be bought and put on from year to year. It covers besides this the matter of green manures and cover crops, of time and depth of tillage, of the water and air supply in the soil, of feeding of the soil bacteria, as well as consideration of the natural resources of the soil itself. In a word, the machinery of the soil largely conditions the effect of any fertilizer applied to it.

The raw materials which are delivered to a factory do not alone determine its output. The kind of machinery and the activity and skill of the labor are quite as important and call for vastly more study and skill than the supply of raw material itself. The cotton, or pig iron, or wool put into the works doesn't increase production unless the machinery is there and working properly for manufacture. Now the things which I have named (water, air, soil, bacteria, crop residues, and a proper condition as regards acidity) are the machinery of the land by which the added plant food is made available to crops.

The kind and quantity of raw materials which every year go to make up the product (wood, leaves and fruit) on an acre of orchard are pretty well known. They are about 60 to 70 pounds of nitrogen, 15 to 20 pounds of phosphoric acid, 55 to 80 pounds of potash, and 30 to 40 pounds of lime, with other elements which will be supplied along with these four things in the fertilizers used. The air of course supplies the larger part of the manufactured product and is beyond our care.

But these facts and figures do not answer the fertilizer question; they only introduce it. The quantity of plant food which it pays to supply and in what form and at what time are the questions hard to answer. And the answers cannot be general. Each soil, each season, each individual set of farm conditions must modify the soil treatment. Here is where the manager of each kind of soil machinery must exercise his individual judgment and knowledge. Here is where the skill and experience of the orchardist come in.

Rules for using fertilizers on orchards, then, can only be of the most general kind, rather principles than rules, under which practice must vary this way and that, to meet different conditions as they arrive.

Regarding Cover Crops.

I think we all agree as to their value in gathering up the soluble plant food left in the soil, in checking erosion, and especially in gathering from the air the organic matter (humus-forming material) which furnishes the food and home of the necessary soil bacteria.

To illustrate: Last spring Mr. Southwick of the Hartford County Farm Bureau, took samples from very carefully measured areas in tobacco fields where timothy had been sown the year before after harvesting tobacco. These are taken to the depth of the plowshare (6 to 7 inches) and at the station we very carefully washed out the whole root system, and weighed and analyzed the grass with the roots. We found that on the fields tested in this way this winter cover had gathered from soil and air over 6,900 pounds of vegetable matter (nearly 3½ tons) 180 pounds of nitrogen, 72 of phosphoric acid and 178 of potash.

So almost incredible did these figures appear that we shall repeat the tests next spring, but this fall, on the 21st of November, we drew samples of timothy in the same way, which gave us 2,800 pounds of organic matter, 68 pounds of nitrogen, 32 of phosphoric acid and 61 of potash. This is only the fall growth. The quantities will be much larger in the spring sampling. This contains as much organic matter as four tons of stable manure and as much nitrogen, phosphoric acid and potash as five tons.

It must be understood that these are possibly extreme cases. The tobacco soil has been very heavily fertilized; the timothy was put in early and heavily seeded. I do not anticipate that any such quantities of plant food will be taken up by an ordinary cover crop in an orchard, although the organic matter may be quite as large or larger.

The building up of our soils largely depends upon the addition of organic matter and making conditions suitable for its rapid decomposition. Stable manure has been our main dependence for this, but it cannot be much longer. The automobile has supplanted the horse. It can smell just as badly, but its droppings consist only of oil, nuts and bolts, —and occasionally passengers.

On farms which do not keep a herd of cattle the supply of manure is mostly gone.

The shortage of manure, which is likely to be permanent, creates a serious condition, felt worst perhaps by market gardeners.

My feeling is that more care must be paid to the making of manure on the farm. All organic wastes, peat, straw, weeds, and even roadside trimmings can be used for bedding or thrown into the pig pen or manure pile to rot, ferment, gather a population of bacteria, and thus increase the active ferments which will convert our crops into humus and release the mineral plant food in them.

Now it is not likely that the organic matter of all cover crops is as immediately valuable as that of stable manure, which is already charged with bacteria and so more rapidly breaks down and releases the plant food in it, but in time, and particularly with a small dressing of manure, as a ferment and with lime, it certainly builds up the land.

I have not time to discuss the various cover crops in use and it is hardly necessary, but I am sure that we need to give a larger place than ever to them in our orchard practice as well as in general farming. Let me add a word or two as to their use.

It is a commonly accepted principle that the growth of fruit trees should be stimulated, if at all, early in the season, and should slow up or cease in summer, so that this growth may harden off before cold weather.

We stimulate growth by fertilizers and manures and by tillage. The vigorous growth is checked in summer by the cover crop, which stops tillage, takes soluble plant food from the soil and holds it for the next season, and also diminishes the water supply.

If our seasons were all alike, this would serve as a general rule. But the vagaries of our weather call for the greatest care and skill of the orchardist, who is the factory manager, in handling his tillage and cover crop.

If he has a very heavy cover crop, especially if it is a nitrogen-gatherer, and his trees have made good growth the year before, he may well hesitate before putting on any nitrogenous fertilizer or tilling the land as much as usual.

If the season is very dry, he will cultivate shallow for a longer time and hold off sowing a cover crop till later.

I have seen a peach orchard bearing a good crop of fruit with heavy foliage in a time of extreme drought, while other orchards nearby parched and bore only inferior fruit. The reason was that the owner kept his cultivators going, set shallow, clear through August, while others "followed the rule."

If a severe drought comes when the cover crop has grown large, it is a question whether it will not pay to roll or drag it, using it as a mulch, rather than let it take the necessary water from the fruit crop.

One of the questions which I am asked to disclose is, "How late should apple orchards be cultivated?" What I have said indicates the answer. In a good season, perhaps by July. In a very dry season, later, but this is not so necessary in mature orchards as in those newly set or in peach orchards. Watch your trees as you watch the individual cows in your herd. The soil is not alike throughout the whole orchard.

It may not pay to till differently or to change the time of sowing the cover crop in its different parts. But I believe it will pay sometimes to use more fertilizer on some trees or sections of the orchard than on others. All the machines in your factory do not run quite alike.

REGARDING COMMERCIAL FERTILIZERS FOR ORCHARDS.

My belief is that at the present time stable manure is out of place in mature orchards, generally speaking, because it is more needed for annual crops which are more dependent on the texture and quality of the surface soil, and these are more improved by manure than by chemicals. The cost of applications also is less, in many cases, because of a longer haul and the hilly land where orchards are planted.

Nitrate of soda put on as soon as the trees start, seems the best thing to advise this year where nitrogen is needed. Nitrate is now the cheapest form of nitrogen, it is quickly taken)up, makes early growth and gives a chance for this growth to harden up before fall and winter. Now is the time to buy. It may be cheaper later, but I see no prospect of it. Nitrate costs about 33 per cent more than before the war, but other forms of nitrogen cost double or more.

HOW MUCH SHALL WE USE?

As much as you need. As I have said before, if your trees have made satisfactory growth and if you are turning under a heavy cover crop and you can get labor for tillage, you may not need any. For land in fair condition I think 150 to 200 pounds per acre is a fair dressing.

IS SULPHATE OF AMMONIA AN ECONOMICAL SOURCE OF NITROGEN?

Its fertilizing value is not far from that of nitrate of soda. Large applications tend to increase soil acidity, but in moderate amount, or in larger amount on limed land, this is not likely to be a damage. At this writing it is quoted wholesale at $140 per ton, which would make its retail price about $168 and the cost of nitrogen per pound about 40 cents, while nitrate of soda is sold for about 25 cents, making nitrate the cheaper purchase.

WHAT ABOUT PHOSPHORIC ACID?

We have used 200 to 400 pounds of acid phosphate with satisfaction. It comes high this year, costing from \$25 to \$30 per ton for 16 per cent goods, or from 8 cents to 9½ cents per pound for phosphoric acid, more than twice its pre-war price.

WHAT ABOUT POTASH?

There is very little potash which farmers can buy unmixed. Its cost in mixed fertilizers this year is about half what it was a year ago. Then it cost about 30 cents per pound of actual potash; now, in mixed goods, it costs about 15 cents. My own guess is that for our mature apple trees I shall use 200 pounds nitrate and 300 acid phosphate per acre and omit potash. For the peaches and young apples, just bearing, I shall use to the acre one-half ton of a 1-8-4 mixture and 150 pounds of nitrate, together costing \$28.00. The 1-8-4 I can buy today for \$44.64 cash. I know of no other way to get potash. This will add, per acre, about 31 pounds of nitrogen, 80 of phosphoric acid and 40 of potash.

AS TO LIME.

In our tests at Yalesville we have found no advantage as yet but rather a disadvantage from lime on a peach orchard. Other soils may do better for it. I have no advice to give.

Another question is, "What do you think of Barium-Phosphate?" I may as well speak of that here.

Barium-Phosphate is a misnomer. It is not a phosphate of barium, as the name implies, but the trade name of a mixture of ground apatite with an impure barium sulphide. The amount of real barium sulphide in our analysis did not exceed about 3.2 per cent.

Two grades are sold: A with 28 per cent and B with 16 per cent of phosphoric acid guaranteed.

Apatite is a natural phosphate and is one of the least soluble forms.

The manufacturers claim that when this mixture is used with manure the same money's worth will produce larger crops than acid of phosphate the first year and that land fertilizer with Barium-Phosphate becomes each year increasingly productive; also that "manure treated with Barium-Phosphate is more than twice as effective as manure not so treated. If it has taken 20 loads of manure to produce a crop of corn on your land before, it is a fact, that ten loads of manure to each of which has been added 100 pounds of Barium-Phosphate, will without any question, produce as much and probably more." These are extraordinary claims—advertising claims—but I can find no facts which support them, but others which contradict them.

Then besides these we have the testimony of farmers who have tried the material and are satisfied that it has given good results. These are entitled to much great weight. This testimony is good as far as it goes, but to my mind it is not convincing. Take a single example, and I cite it to illustrate the difficulty of drawing definite conclusions from a general observation of the crop. I quote from a recent publication:

"We have been more than pleased with the crop results obtained from the use of barium-phosphate both in the field and greenhouse. The onion crops of 1918 and 1919 were more than satisfactory."

Then follows a description of the writer's method of using it. He sowed his onions on plowed clover sod land, to which 1,600 pounds of tankage and 1,800 pounds of Barium-Phosphate were applied. Then, when the onions were 8 to 10 inches high, he put on 250 to 300 pounds more of the Phosphate and later still 200 pounds of nitrate. And he was well satisfied with the result.

To make a claim is the easiest thing in the world; to establish a fact regarding a particular fertilizer by field tests is one of the hardest.

But can he, or anyone else, tell whether any part of this successful crop was due to Barium-Phosphate and what part to the effect of clover sod, to the 1,600 pounds of tankage and to the 200 pounds of nitrate of soda? I certainly cannot.

The only careful tests of the matter which have come to my notice are the following:

At the Rhode Island Station a greenhouse experiment was made with lettuce in pots. Calling the yield of soil with phosphate applied 100, the soil with one ton to the acre of

Barium-Phosphate also yielded 100, while soil with ½ ton of acid phosphate added yielded 238. In other words, the Barium-Phosphate had no effect at all.

Since it is claimed to be a soil-neutraliser also, calling the yield of soil alone 100, with one ton of Barium-Phosphate added the yield was 100, but soil with 2-3 of a ton of slaked lime yielded 557. That is, there was no effect in neutralizing the soil observable with Barium-Phosphate.

The Maine Station made a field test on an acre of soil which responded to applications of phosphates. Turnips were grown. The yields were as follows:

No phosphate	234	bushels
Barium-Phosphate ...	203	“
Barium sulphide	219	“
Floats	525	“
Acid phosphate	520	“

That is, on a soil and a crop where even floats yielded as much as acid phosphate—more than doubling the crop grown with no added phosphate—Barium-Phosphate or barium sulphide yielded no more—even less—than the checked plot.

Now a fertilizer which will wonderfuly “reinforce” manure must have some fertilizing value in itself. These careful tests do not show it.

The matter needs no further discussion.

It is my opinion that this ground apatite, and any other insoluble phosphate, should be used only in connection with stable manure (which is a very scarce article on my farms) or with cover crops, that it should be tried only experimentally, not as a main dependence, and tested in soils known to respond to phosphate and in such a way as to prove or disprove its exact effect on production as compared with bone or acid phosphate. On some soils and in connection with manure, floats have proved to be of value—not, I think, in the most extended trials as economical as acid phosphate, but there is a great difference in the solubility of crysaline apatite as compared with soft Florida or Tennessee floats, and no reason to suppose that it will yield as favorable results.

That any phosphate under proper conditions will increase the crop somewhat—if and only where phosphoric acid is the deficient element in the soil—is certain. I believe very strongly that in ordinary farm practice where soils are deficient in humus, bone, acid phosphate and Thomas slag will prove more profitable than raw phosphates.

In general, on our heavier soils crops are more likely to respond to phosphates; on the light soils potash is more needed.

THE BORAX SITUATION.

The facts: In 1919 reports from several states indicated serious crop injury from borax contained in the fertilizers used. Some potato crops in Maine were ruined and the symptoms were those of borax poisoning. In these cases 1,500 to 2,000 pounds of fertilizer had been applied in the drill near the seed.

The Station has found no evidence of borax damage in Connecticut.

WHAT IS BEING DONE ABOUT IT?

1. The United States Department of Agriculture, under its wartime powers, has forbidden manufacturers to sell for fertilizer use any chemicals which contain more than 5 per cent. of borax. It considers 2 pounds of borax per acre as the limit of safety when applied in the drill, and 10 pounds if the fertilizer is broadcast.

The Department has also forbidden manufacturers to sell fertilizers containing more than 0.1 per cent of borax unless the amount present is plainly shown on the label. This means that if a farmer uses not more than 500 pounds of fertilizer per acre in the drill no injury is to be expected if it contains not more than 0.4 per cent of borax. If sown broadcast, a maximum of 2 per cent of borax is not dangerous.

2. The Association of Experiment Stations of the Northeastern States is making a cooperative test of the action of borax on several crops, and hopes by early April to have some further information on the limits of safety for several crops.

3. The manufacturers of mixed fertilizers fully understand the danger from borax, which threatens their interests

as well as those of the farmer. There is very little chance therefore of putting out fertilizers containing dangerous amounts of borax.

WHAT USERS OF FERTILIZERS NEED TO UNDERSTAND.

a. The danger from borax in fertilizers this year is believed to be quite remote. The only goods which might be suspected are stocks left over from last year which contain 4 per cent or more of potash.

b. It is claimed with apparent reason that borax in very minute quantity, and therefore having no effect on crops, has been found in nitrates, fish scrap, acid phosphate and even German potash salts. A trace of borax in a fertilizer is to be considered normal and not injurious.

The Station will test samples for borax, if desired, only determining the amount (a time-consuming operation) in samples where the qualitative test shows the presence of appreciable amounts.

c. There is much more likelihood of unnecessary alarm than of insufficient precaution regarding borax in fertilizers.

OFFICIAL LIST OF SOCIETIES HOLDING FAIRS IN 1918

Name of Society.	President	Secretary	Treasurer
Avon School Fair Corporation	J. W. Alsop	F. A. Robotham	J. J. Anderson
Brookfield School Agri. Society	G. H. De La Vergne	Charles L. Biggs	Randolph Williams
Chester Agri. & Mechanical Society	Theodore Foster	Clarence F. Spencer	Edgar W. Lewis
Conn. Bee-Keepers' Association	David D. Marsh	L. Wayne Adams	L. Wayne Adams
Conn. Dairymen's Association	C. B. Pomeroy	D. J. Minor	R. E. Buell
Conn. Fair Association	John A. Pilgard	H. C. Parsons	W. H. Gocher
Conn. Pomological Society	W. H. Baldwin	H. C. C. Miles	Minor Ives
Conn. Poultry Association	Paul P. Ives	George V. Smith	C. H. Brundage
Conn. Sheep Breeders' Association	C. L. Gold	H. L. Garrigus	B. C. Patterson
Conn. State Agri. Society	Charles M. Jarvis	L. W. Gwatkin	B. H. Atwater
Coventry Grange Fair Association	Arthur L. Reed	Edith P. Haven	Edith P. Haven
Danbury Fair	Samuel H. Rundle	G. M. Rundle	G. M. Rundle
Durham Agri. Fair Association	Henry P. Ryan	Frederick H. Page	Julius J. Rich
Fairfield County Farm Bureau	Seth L. Pierrepont	E. I. Olmstead	G. M. Rundle
Goshen Agri. Society	E. O. Wright	George Cook	F. J. Seaton
Granby Agri. Society	Philip E. Devnew	Charles Allshouse	Harold Cotton
Guilford Agri. Society	F. B. Bishop	Robert DeF. Bristol	William C. White
Haddam Neck Grange Agri. Association	R. S. Bailey	C. G. Crocker	A. T. S. Clark
Harwinton Agr. Society	H. J. Newbury	R. G. Bentley	M. L. Drake
Lyme Grange Fair Association	William Marvin	J. W. Stark	A. G. Sweet
Mansfield Fair Association	C. H. Savage	A. J. Brundage	A. E. Anthony
Middlebury Agri. Society	Frank A. Waters	Mrs. Allan A. Clark	A. F. Greene
Middlesex County Farm Bureau	F. S. Chapman	John H. Fay	C. M. Bowen
Mount Carmel Agri. Associaton	Willis M. Cook	F. F. Lincoln	B. J. Dickerman
New Haven County Farm Bureau	Wilson H. Lee	Herbert D. Deetz	George E. Tester
New Haven County Hort. Society	George A. Cromie	William J. Rathgeber	David Kydd
New London County Agri. Society	James B. Palmer	Gilbert S. Raymond	Albert J. Bailey
New London County Improvement League	C. P. Bushnell	Louise C. Howe	C. A. Hagberg
Norfolk Agricultural Association	Amos F. Barnes	C. B. Uffendale	Mrs. H. E. Stevens
North Canaan Agri. Fair Association	R. M. Timberlake	Jessie C. Donalds	Robert Fuller
North Stonington Grange Fair Ass'n	George D. Coats	E. Frank White	George H. Stone
Plainfield Garden-Food Club	Henry Dorrance	Cecil L. Butler	Cecil L. Butler
Plainville Agri. Society	Charles H. Norton	Henry Trumbull	Theodore A. Lyman
Redding Fair Corp. for Public Schools	J. B. Sanford	Samuel C. Shaw	William C. Sanford
Rockville Fair Association	O. A. Leonard	P. B. Leonard	Charles M. Squires

Salisbury Association	Robert Scoville	Malcolm D. Rudd	Malcolm D. Rudd
Sharon Agricultural Society	Frank W. Dakin	George B. Klebes	Walter K. Landon
Tolland County Farm Bureau	C. A. Thompson	H. L. Hamilton	E. S. Edgerton
Union Agri. Society of Barkhamsted, Colebrook and Hartland—Riverton	L. A. Coe	H. P. Deming	F. B. Appel
Washington Fair Corp.	H. O. Averill	C. E. Hough	S. L. Hollister
Waterbury Public Schools Agri. Society	E. V. Conley	William D. Shea	Peter Fitz Henry
Windham County Agri. Society	H. B. Chapman	M. J. Frink	W. R. Thurber
Windham County Farmers' Ass'n.	Everett E. Brown	F. B. Harrison	W. M. Gallup
Windsor Agri. Society	N. H. Batchelder	J. E. Luddy	Daniel Howard
Wolcott Agri. Society	A. T. Gilyard	M. E. Pierpont	M. E. Pierpont
Woodstock Agri. Society	George M. Sampson	L. H. Healey	Melancthon Riddick

OFFICIAL LIST OF SOCIETIES HOLDING FAIRS IN 1919

NAME OF SOCIETY.	PRESIDENT	SECRETARY	TREASURER
Avon School Fair Association	J. W. Alsop	J. J. Anderson	F. A. Robotham
Brookfield School Fair Association	Geo. H. De La Vergne	Chas. Lewis Biggs	Randolph B. Williams
Chester Agri. & Mechanical Society	Theodore Foster	Clarence F. Spencer	Edgar W. Lewis
Colchester Grange & School Fair	Clayton G. Miller	Belle L. Strong	Ella C. Browning
Connecticut Bee Keepers' Association	Rev. D. D. Marsh	L. Wayne Adams	L. Wayne Adams
Connecticut Dairymen's Association	Robert Mitchell	Dwight J. Minor	M. E. Pierpont
Connecticut Fair Association, Inc.,	J. A. Pilgard	H. C. Parsons	W. H. Gocher
Connecticut Horticultural Society	G. H. Hollister	A. Dixon	W. W. Hunt
Connecticut Pomological Society	W. H. Baldwin	H. C. C. Miles	H. M. Rogers
Connecticut Poultry Association	W. F. Kirkpatrick	Paul P. Ives	C. H. Brundage
Connecticut Sheep Breeders' Association	Henry Dorrance	H. L. Garrigus	B. C. Patterson
Connecticut State Agricultural Society	Wm. H. Webster	R. O. Clark	B. H. Atwater
Connecticut Vegetable Growers' Association	H. S. Coe	W. C. Pelton	Chas. R. Risley
Cornwall Agricultural Society	S. R. Scoville	C. W. Hart	A. M. Clark
Coventry Grange Fair Association, Inc.,	Arthur L. Reed	Edith P. Haven	Edith P. Haven
Danbury Fair	S. H. Rundle	G. M. Rundle	G. M. Rundle
Durham Agricultural Society	H. C. Parsons	J. J. Riche	F. H. Page
East Haddam Grange Fair Association	R. W. Bingham, Jr.,	S. D. Brainard	William F. Palmer
East Haven Fair Association, Inc.,	F. G. Reveley	E. M. Allender	W. P. Baldwin
Farmington Grange Fair Association	Warren S. Mason	Arthur J. Birdseye	Frank E. Moses
Goshen Agricultural Society	E. O. Wright	Geo. Cook	F. J. Seaton
Granby Agricultural Society	P. E. Devnew	Chas. Allshouse	Harold B. Cotton
Guilford Agricultural Society	F. B. Bishop	Robert DeF. Bristol	Wm. C. White
Haddam Neck Grange Agricultural Society	R. S. Bailey	C. G. Crocker	A. T. S. Clark
Harwinton Agricultural Society	H. J. Newbury	R. G. Bentley	M. L. Drake
Hebron School Agricultural Society	Edward A. Smith	Clarence P. Rathbun	Howard Porter
Lyme Grange Fair Association	Wm. Marvin	J. W. Stark	A. G. Sweet
Madison Agricultural Society	P. G. Watrous	J. M. Marsh	J. M. Hull
Mansfield Fair Association	C. H. Savage	A. J. Brundage	A. E. Anthony
Marlborough School Agricultural Society	John Rankl	Roy B. Pettengill	Frank H. Blish
Middlebury Agricultural Society	F. A. Waters	Mrs. Allan Clark	A. F. Greene
Mt. Carmel Agricultural Society	F. F. Lincoln	C. F. Dickerman	B. J. Dickerman
New Haven County Horticultural Society	G. A. Cromie	Wm. J. Rathgeber	David Kydd
New Haven County Farm Bureau	W. H. Lee	H. D. Deetz	G. E. Tester
New London County Agricultural Society	Elmer R. Pierson	Gilbert S. Raymond	Albert J. Bailey

New London County Improvement League	J. D. Avery	E. M. Sevin	G. S. Raymond
Norfolk Agricultural Society	W. E. Baker	C. B. Uffendale	Mrs. C. M. Stevens
No. Canaan Agricultural Society	N. W. Hardenburgh	A. W. Holsapple	R. T. Fuller
No. Stonington Grange Fair	G. D. Coats	E. F. White	C. B. Thompson
Plainfield Garden-Food Club	Henry Dorrance	Cecil L. Butler	Cecil L. Butler
Plainville Agricultural Society	C. H. Horton	Henry Trumbull	Theo. A. Lyman
Plymouth Fair Corporation	E. Nelson Canfield	Edith E. Sutliffe	Edith E. Sutliffe
Portland Hemlock Grange Fair Association	F. C. Payne	F. C. Barker	A. F. Kingsbury
Redding School Fair Corporation	J. B. Sanford	S. C. Shaw	W. C. Sanford
Rockville Fair Association	O. A. Leonard	P. B. Leonard	Chas. M. Squires
Boys' and Girls' Garden Clubs Exhibition, Salisbury Association, Inc.	Robert Scoville	Malcolm D. Rudd	Malcolm D. Rudd
Sharon Agricultural Society	Frank W. Dakin	G. B. Klebes	W. K. Landon
Stafford Springs Agricultural Society	W. H. Hall	R. W. Smith	G. Siswick
Tolland County Farm Bureau	C. H. Savage	H. L. Hamilton	E. S. Edgerton
Union Agri. Society of Barkhamsted, Colebrook, Hartland—Riverton	L. A. Coe	H. P. Deming	F. B. Appel
Union Agri. Society of Ellington, Enfield, Somers & East Windsor	R. A. Sikes	Chas. Brainard	C. A. Thompson
Washington Fair Corporation	H. O. Averill	C. E. Hough	S. L. Hollister
Waterbury Fair Corp. for Public Schools	Edw. V. Curley	B. W. Tinker	B. A. McDonald
Wethersfield Grange Corporation	B. A. Harris	F. S. Morris	F. S. Morris
Windham County Agri. Society	H. B. Chapman	M. J. Frink	W. R. Thurber
Windham County Farmers' Association	Everett E. Brown	Whitman Danielson	Wm. M. Gallup
Windsor Agricultural Society	Daniel Howard	Oliver J. Thrall	E. F. Parker
Wolcott Agricultural Society	A. T. Gilyard	M. E. Pierpont	M. E. Pierpont
Woodstock Agricultural Society	Geo. M. Sampson	Leonard H. Healey	M. Riddick

OFFICIAL LIST OF SOCIETIES HOLDING FAIRS IN 1920

NAME OF SOCIETY.	PRESIDENT	SECRETARY	TREASURER
Avon School Fair Association	J. W. Alsop	J. J. Anderson	Frank Robotham
Bethany Grange Town Fair	T. D. Davidson	W. S. Saxton	N. J. Peck
Brookfield School Agri. Fair Ass'n.	Geo. H. De La Vergne	Chas. L. Biggs	Randolph Williams
Cherry Park Fair	Wm. T. Grozier	C. H. Brazel	M. W. Delaney
Chester Agri. & Mechanical Society	Theo. Foster	Clarence F. Spencer	Edgar W. Lewis
Colchester Grange Fair Corporation	Clayton G. Miller	Belle L. Strong	Ella C. Browning
Conn. Bee-Keepers' Association	Henry Lankton	Louis St. Clair Burr	Louis St. Claire Burr
Conn. Dairymen's Association	Robert Mitchell	Dwight J. Minor	M. E. Pierpont
Conn. Fair Association	John A. Pilgard	H. C. Parsons	W. H. Gocher
Conn. Horticultural Society	W. S. Mason	S. H. Deming	W. W. Hunt
Conn. Pomological Society	Prof. A. T. Stevens	H. C. C. Miles	H. M. Rogers
Conn. Poultry Association	W. F. Kirkpatrick	Paul P. Ives	C. H. Brundage
Conn. Sheep Breeders' Association	Henry Dorrance	H. L. Garrigus	B. C. Patterson
Conn. Vegetable Growers' Association	H. B. Williams	William Valentine	Charles R. Risley
Cornwall Agricultural Fair Association	Asa C. Borland	C. W. Hart	Chas. L. Gold
Coventry Grange Fair Association, Inc.	A. L. Reed	Edith P. Haven	Edith P. Haven
Danbury Fair	S. H. Rundle	G. M. Rundle	G. M. Rundle
Durham Agri. Fair Association	H. C. Parsons	F. H. Page	J. J. Rich
East Haven Fair Association	W. J. Carr	E. M. Allender	J. H. Gates
Fairfield County Farm Bureau	F. H. Beers	M. B. Sunderland	S. L. Pierrepont
Farmington Grange Fair Association	Warren S. Mason	Arthur J. Birdseye	Frank E. Moses
Goshen Agricultural Society	E. O. Wright	George Cook	F. J. Seaton
Granby Agricultural Society	P. E. Devnew	Charles Allshouse	H. B. Cotton
Guilford Agricultural Society	H. W. Carter	R. DeF. Bristol	W. C. White
Haddam Neck Grange Agri. Association	John L. Kruger	Emerson G. Clark	Adelbert T. S. Clark
Harwinton Agricultural Society	H. J. Newbury	R. G. Bently	M. L. Drake
Hebron School Agricultural Association	Edward A. Smith	Clarence P. Rathbun	Howard C. Porter
Lyme Grange Fair Association	T. M. Peck	J. W. Stark	A. G. Sweet
Madison Agricultural Society	C. A. Theis	P. G. Watrous	J. M. Hull
Mansfield Fair Association	H. Storrs	A. J. Brundage	L. J. Storrs
Marlborough School Agri. Fair Ass'n.	John P. Rankl	Roy B. Pettengill	Frank H. Blish
Middlebury Agricultural Society	F. A. Waters	H. E. Clark	A. F. Green
Middlesex County Farm Bureau	S. Russell, Jr.	John H. Fay	C. M. Bacon
Mt. Carmel Agricultural Society	Howard C. Yale	Clifford F. Dickerman	Bennett J. Dickerman
New Haven County Farm Bureau	Wilson H. Lee	Herbert D. Deetz	Geo. E. Tester

New Haven County Horticultural Society	Alfred E. Doty	Wm. J. Rathgeber	David Kydd
New London County Agricultural Society	Elmer R. Pierson	Gilbert S. Raymond	Albert J. Bailey
New London County Improvement League	C. J. Abell	Miss Holdridge	W. D. Copp
North Stonington Agricultural Fair Ass'n.	Geo. D. Coates	E. Frank White	Clifford Thompson
Plainville Agricultural Association	L. S. Mills	Henry Trumbull	T. A. Lyman
Plymouth Fair Corporation	E. N. Canfield	Edith Sutliffe	George Chapman
Portland Hemlock Grange Fair Ass'n	F. C. Payne	F. C. Barker	A. F. Kingsbury
Redding School Fair Association	J. B. Sanford	S. C. Shaw	W. C. Sanford
Rockville Fair Association	O. A. Leonard	P. B. Leonard	C. M. Squires
Salisbury Association, Inc.	Robert Scoville	Malcolm D. Rudd	Malcolm D. Rudd
Stafford Springs Agricultural Society	W. H. Hall	R. W. Smith	George Siswick
Tolland County Farm Bureau	C. H. Savage	H. L. Hamilton	E. S. Edgerton
Union Agri. Society of Barkhamsted, Colebrook and Hartland—Riverton	L. A. Coe	H. P. Deming	F. B. Appel
Union Agri. Society of Somers, Enfield, Ellington and East Windsor	Edw. W. Courtney	Benjamin A. Gager	C. A. Thompson
Washington Fair Corporation	H. O. Averill	C. E. Hough	S. L. Hollister
Waterbury Fair Corp. for Public Schools	E. V. Curley	B. W. Tinker	B. A. McDonald
Wethersfield Grange Corporation	Burton A. Harris	Frank F. Morris	Frank F. Morris
Windham County Agricultural Society	H. B. Chapman	M. J. Frink	W. R. Thurber
Windsor Agricultural Society	Oliver J. Thrall	J. C. Conklin	I. F. Parker
Wolcott Agricultural Society	A. T. Gilyard	M. E. Pierpont	M. E. Pierpont
Woodstock Agricultural Society	Geo. M. Sampson	Leonard H. Healey	Melancthon Riddick

RETURNS OF AGRICULTURAL SOCIETIES, 1918, FINANCES.

Name of Society	Cash on Hand	Single Admission Tickets	Membership or Season Tickets	Grand Stand	Entrance Fees Trials of Speed	Other Entrance Fees	Rent of Grounds	Other Sources	State Appropriation	Donations and Unclaimed Premiums	Total
Avon School Fair Corporation								$101.10		$50.00	$151.10
Brookfield School Fair Ass'n.		$20.55						101.50			122.05
Chester Agricultural & Mechanical Society		162.35	$16.75				$26.00	225.44	200.00	2.25	632.79
Connecticut Bee Keepers' Ass'n.	$120.37		136.00			$17.25		440.98	300.00		1,014.60
Connecticut Dairymen's Association	774.16		119.00			20.27	285.00	422.81	839.25	300.00	2,760.49
Connecticut Fair Association	5,741.93	35,408.18		$7,843.00	$15,739.00	687.47	11,532.73	1,581.69	500.00		78,534.00
Connecticut Pomological Society	748.28		513.00					138.64	400.00		1,799.92
Connecticut Poultry Association	800.00		174.00					100.00	1,000.00		2,074.00
Connecticut Sheep Breeders' Association	112.28		50.50						946.47		1,109.25
Connecticut State Agricultural Society		8,560.75	30.00	297.70	1,349.00	94.00	3,036.83	3,378.75	4,500.00	2,274.74	23,521.77
Coventry Grange Fair Association	2.73	85.75					8.00	456.33	150.00		702.81
Durham Agricultural Fair Ass'n.	97.69	634.83	171.00			8.00	102.00	530.05	350.00	2.24	1,895.81
Fairfield County Farm Bureau								152.50			152.50
Goshen Agricultural Society	549.53	774.00					238.75	27.58	250.00	10.00	1,849.86
Granby Agricultural Society	314.17	828.00		156.75	235.50		350.00	846.00	400.00		3,130.42
Guilford Agricultural Society	289.20	307.20	184.50			83.90	6.00	220.86	500.00	216.15	1,807.81
Haddam Neck Grange Agr. Society	183.05	356.21				9.30	33.95	889.28	150.00	107.75	1,729,54
Harwinton Agricultural Society			2.75			83.25	315.00	96.71	200.00		697.71
Lyme Grange Fair Association	52.71	367.15					40.00	334.20	150.00		944.06
Mansfield Fair Association	15.73	172.55	26.50					378.81	200.00	5.30	798.89
Middlebury Agricultural Society	226.00	359.30	75.00				56.50	179.13			395.93
Middlesex County Farm Bureau										132.00	132.00
Mt. Carmel Agricultural Society		89.55	20.50			1.00	3.66	171.34		70.91	356.96
New Haven County Farm Bureau								148.45			148.45
New Haven County Horticultural Society	10.12		42.00					121.45	150.00	133.00	456.57
New London County Agricultural Society	397.33	8,255.25	275.00	1,026.25	1,870.00	7.00	1,329.62	449.87	500.00		14,610.32

New London County Improvement League	....	....	....	....	....	....	....	21.01	100.00	50.00	171.01
Norfolk Agricultural Society	209.39	652.35	147.00	40.00	....	171.10	....	118.20	350.00	100.00	1,788.04
No. Canaan Agricultural Fair Association	....	19.50	20.00	....	....	....	....	100.00	....	14.19	153.69
No. Stonington Grange Fair	433.39	871.55	....	....	....	70.50	204.00	831.95	500.00	....	2,911.39
Plainfield Garden-Food Club	....	22.02	....	....	....	....	....	93.50	450.00	....	565.52
Plainville Agricultural Association	....	....	....	....	....	....	....	....	....	200.00	200.00
Redding School Fair Association	....	12.20	....	....	....	....	....	....	....	102.02	114.22
Rockville Fair Association	3,795.09	2,346.35	161.00	968.15	917.00	317.50	779.00	272.75	500.00	....	10,056.84
Salisbury Association Inc.,	....	....	....	....	....	....	....	....	....	353.50	353.50
Sharon Agricultural Society	....	80.90	....	....	....	....	....	144.50	....	10.00	235.40
Tolland County Farm Bureau	....	....	....	....	....	....	....	127.54	....	25.00	152.54
Union Agri. Society of Barkhamsted, Colebrook, Hartland-Riverton	57.37	....	40.50	....	....	1.70	....	12.00	500.00	2.00	613.57
Washington Fair Corporation	409.55	1,612.00	....	....	....	....	242.50	215.20	300.00	210.00	2,989.25
Waterbury Fair Corp. for Public School	....	71.51	....	....	....	....	....	447.72	....	....	519.23
Windham County Agricultural Society	683.82	1,720.42	86.00	161.50	67.50	120.67	313.00	34.90	500.00	....	3,687.81
Windham County Farmers' Association	....	....	....	....	....	....	....	178.25	....	....	178.25
Windsor Agricultural Society	....	....	....	....	....	....	....	102.26	....	220.28	322.54
Wolcott Agricultural Society	....	547.75	38.00	....	42.50	....	118.50	175.60	300.00	....	1,222.35
Woodstock Agricultural Society	134.18	1,158.65	....	145.05	184.00	71.80	246.00	881.71	500.00	15.00	3,336.39
[redacted]											

RETURNS OF AGRICULTURAL SOCIETIES, 1919, FINANCES.

Name of Society	Cash on Hand	Single Admission Tickets	Membership or Season Tickets	Grand Stand	Entrance Fees Trials of Speed	Other Entrance Fees	Rent of Grounds	Other Sources	State Appropriation	Donations and Unclaimed Premiums	Total
Avon School Fair Association								$100.00		$42.60	$142.60
Brookfield School Fair Association	$11.70	$18.00						100.00		46.00	175.70
Chester Agricultural & Mechanical Society		267.15	$19.75				76.00	175.36	250.00	1.30	789.56
Colchester Grange & Colchester School Fair								100.00		14.00	114.00
Connecticut Bee-Keepers' Association	14.59					$16.25	45.00	467.25	300.00		843.09
Connecticut Dairymen's Association	222.38		142.00					1,728.72	350.00	225.00	2,668.10
Connecticut Fair Association, Inc.	7,932.85	33,308.60		$9,069.00	$16,479.50	659.00	13,368.63	1,859.54	500.00		83,177.12
Connecticut Pomological Society	124.68							217.48	600.00		942.11
Connecticut Poultry Association	741.40							428.00	1,000.00		2,169.40
Connecticut Sheep Breeders' Ass'n.	326.45		98.00						802.06		1,226.51
Connecticut State Agricultural Society		9,310.50	150.00	386.50	576.00	92.75	4,629.05	5,221.85	4,500.00		24,816.15
Cornwall Agricultural Society		99.15					27.00		100.00	16.67	242.82
Coventry Grange Fair Ass'n. Inc.,	18.68	85.75					17.50	556.28	150.00	13.85	842.06
Durham Agricultural Society	130.30	758.45	157.50			10.00	218.25	524.34	400.00		2,198.84
East Haddam Grange Fair Association	13.91										13.91
East Haven Fair Association, Inc.,		420.30	123.00			1.25	75.00	49.10		24.00	692.65
Farmington Grange Fair Association		219.00					5.00	499.51		213.00	986.51
Goshen Agricultural Society	560.40	824.75					273.00	42.24	250.00		1,950.39
Granby Agricultural Society	503.42	1,119.95		184.75	587.50	58.00	345.07	753.50	500.00		4,052.19
Guilford Agricultural Society	395.47	433.13	211.00			96.05	16.00	346.78	450.00	187.34	2,135.77
Haddam Neck Grange Agricultural Society	58.73	270.40				36.15	22.20	1,251.40	250.00	65.50	1,954.38
Harwinton Agricultural Society			.25			119.34	349.75	125.67	200.00		795.01
Hebron School Agricultural Society								125.00		8.10	133.10
Lyme Grange Fair Association	65.73	462.60					45.00	363.79	150.00		1,087.12
Madison Agricultural Society		65.65	58.50			81.65	60.00	234.50	150.00		650.30
Mansfield Fair Association	34.60	276.65	54.00				5.00	397.98	300.00	9.75	1,077.98

Marlborough School Agricultural Society	......	......	......	......	......	......	......	100.00	......	25.25	125.25
Middlebury Agricultural Society	242.06	988.10	87.00	......	......	......	......	231.70	100.00	145.70	1,794.56
Mt. Carmel Agricultural Society	23.66	38.00	15.00	......	......	1.00	.57	80.00	100.00	1.00	259.23
New Haven County Farm Bureau	......	......	......	......	......	......	......	......	......	......	......
New Haven County Horticultural Society	20.39	......	35.00	......	......	......	......	418.79	150.00	121.65	745.83
New London County Agricultural Society	403.61	7,200.50	224.00	971.75	2,220.00	75.75	2,306.55	575.78	600.00	......	14,577.94
Norfolk Agricultural Society	......	787.05	152.00	119.00	......	26.00	40.50	......	350.00	387.00	1,861.55
North Canaan Agricultural Fair Ass'n	4.48	42.25	......	......	......	......	......	124.85	100.00	15.00	286.58
North Stonington Grange Agricultural Soc.	494.49	1,012.90	......	......	......	59.00	93.00	810.41	450.00	......	2,919.80
Plainfield Garden & Food Club	17.96	10.75	......	......	......	......	......	268.50	100.00	......	397.21
Plainville Agricultural Society	15.65	......	......	......	......	......	......	100.00	......	25.75	141.40
Plymouth Fair Corporation	......	407.95	......	......	......	14.35	46.00	303.84	......	......	772.14
Portland Hemlock Grange Fair Ass'n	......	508.35	345.00	......	......	......	69.00	1,064.93	......	......	1,987.28
Redding Fair Corp. for Public Schools	8.97	9.50	......	......	......	......	......	......	......	103.40	121.87
Rockville Fair Association	*505.76	2,418.45	362.50	1,291.50	762.00	27.20	1,204.88	730.63	600.00	288.00	8,190.92
Salisbury Association, Inc.											
Boys' & Girls' Garden Club Exhibit	57.91	......	......	......	......	......	......	30.84	......	702.00	790.75
Sharon Agricultural Society	......	64.00	......	......	......	......	......	68.93	......	10.50	143.43
Stafford Springs Agricultural Society	1,424.59	5,676.20	290.00	2,328.00	980.00	......	2,055.00	316.50	......	......	13,070.29
Tolland County Farm Bureau	......	......	......	......	......	......	......	47.64	100.00	8.00	155.64
Union Agri., Society of Barkhamsted Colebrook, Hartland, Riverton	160.44	1,477.70	26.00	......	......	51.50	322.91	447.54	100.00	42.00	2,628.09
Union Agri. Society of Ellington, Enfield, Somers & East Windsor	642.99	......	2.00	......	......	......	82.00	223.92	......	12.00	962.91
Washington Fair Corporation	426.49	1,689.00	30.00	......	......	......	330.00	218.70	350.00	158.50	3,202.69
Waterbury Public School Agri. Society	......	26.70	......	......	......	......	......	662.82	......	......	689.52
Wethersfield Grange Corporation	101.02	87.35	......	......	......	......	44.00	287.83	......	......	520.20
Windham County Agricultural Society	511.80	2,244.07	83.00	211.25	87.50	122.38	529.00	34.56	600.00	......	4,423.56
Windham County Farmers' Association	......	......	......	......	......	......	......	28.94	100.00	......	128.94
Windsor Agricultural Society	......	......	......	......	......	......	20.00	......	100.00	347.00	467.00
Wolcott Agricultural Society	......	808.00	85.00	......	......	6.00	122.00	218.58	300.00	......	1,539.58
Woodstock Agricultural Society	80.88	1,627.20	......	210.00	186.00	50.75	416.00	187.35	500.00	81.00	3,239.18

RETURNS OF AGRICULT

Name of Society	Expenses of Fair	Premiums for Speed	Premiums for Amusements	Special Exhibits	Other Premiums	Permanent Improvements	
Avon School Agricultural Society	$42.60	....	....	....	$100.00	....	...
Brookfield School Fair Agri. Society	39.60	....	....	....	100.00	....	...
Chester Agri. & Mechanical Society	180.61	....	$33.00	....	184.55	....	$
Colchester Grange & School Fair	14.00	....	....	....	100.00	....	...
Connecticut Bee Keepers' Association	.50	....	....	....	512.00	....	
Connecticut Dairymen's Association	500.32	....	....	....	657.00	....	1
Connecticut Fair Association	13,105.38	$32,500.00	1,910.00	$1,200.00	11,265.00	$1,825.00	1,6
Connecticut Pomological Society	207.29	....	....	....	1,016.00	....	...
Connecticut Poultry Association	210.50	....	....	....	....	....	1
Connecticut Sheep Breeders' Ass'n.	....	....	....	....	319.00	....	...
Connecticut State Agri. Society	6,763.31	2,250.00	1,662.00	4,141.35	....	471.92	2
Cornwall Agricultural Society	25.40	....	....	....	201.25	....	...
Coventry Grange Fair Ass'n. Inc.,	255.11	....	184.36	....	248.10	75.00	
Durham Agricultural Society	684.48	....	125.00	....	984.70	122.37	
East Haddam Grange Fair Ass'n.	....	....	....	....	....	....	...
East Haven Fair Association, Inc.,	184.87	....	80.00	....	208.75	....	...
Farmington Grange Fair Association	....	....	25.00	....	213.00	....	...
Goshen Agricultural Society	687.42	....	210.00	....	659.50	....	
Granby Agricultural Society	499.56	1,000.00	455.00	....	1,108.50	279.50	
Guilford Agricultural Society	417.70	....	138.00	....	735.80	....	
Haddam Neck Grange Agri. Society	650.72	....	187.00	10.00	408.09	430.33	...
Harwinton Agricultural Society	290.49	....	100.00	....	252.05	....	
Hebron School Agri. Society	8.10	....	....	....	100.00	25.00	...
Lyme Grange Fair Association	310.32	....	78.00	....	219.25	200.00	
Madison Agricultural Society	168.39	....	102.20	....	246.40	....	...
Mansfield Fair Association	....	....	62.50	25.00	403.45	14.20	...
Marlborough School Agri. Society	9.60	....	....	....	100.00	....	...
Middlebury Agricultural Society	548.77	....	288.00	25.00	402.50	....	...
Mt. Carmel Agricultural Society	17.35	....	....	15.00	90.75	....	...
New Haven Co. Horticultural Society	107.28	....	....	....	417.00	....	
New Haven County Farm Bureau	....	....	....	....	201.00	....	...
New London County Agri. Society	5,587.98	3,760.00	1,473.33	....	1,556.85	39.00	5
Norfolk Agricultural Society	1,024.53	....	110.00	....	639.15	....	...
No. Canaan Agri. Fair Ass'n.	80.62	....	....	....	....	101.00	...
No. Stonington Grange Agri. Society	818.02	....	100.00	....	920.15	95.00	
Plainfield Garden-Food Club	....	....	....	4.00	118.95	....	1
Plainville Agricultural Society	....	....	....	....	119.60	....	...
Plymouth Fair Corporation	64.10	....	61.00	....	172.40	....	...
Portland Hemlock Grange Fair Ass'n.	792.53	....	163.40	....	602.45	158.96	...
Redding Fair Corp. for Public Schools	4.55	....	....	....	100.00	....	...
Rockville Fair Association	889.63	2,577.00	1,647.71	....	1,037.03	850.00	1
Salisbury Association Inc., Boy's & Girl's Garden Club Exhibit	58.35	....	....	....	189.75	....	5
Sharon Agricultural Society	40.68	....	....	....	102.75	....	...
Stafford Springs Agri. Society	5,199.71	2,275.00	3,048.93	....	1,066.59	345.23	
Tolland County Farm Bureau	17.28	....	....	....	116.00	....	...
Union Agri. Society of Barkhamsted Colebrook, & Hartland—Riverton	438.93	....	104.90	....	922.18	24.10	
Union Agri. Society of Ellington, Enfield, Somers, & East Windsor	....	....	42.00	....	171.10	....	
Washington Fair Corporation	1,476.53	....	....	....	658.90	....	
Waterbury Pub. School Agri. Society	210.00	....	....	....	219.75	....	...
Wethersfield Grange Corporation	35.43	....	....	103.50	280.25	....	...
Windham County Agri. Society	641.11	372.50	320.00	....	1,178.60	340.45	
Windham County Farmers' Ass'n.	16.50	....	....	....	101.75	....	...
Windsor Agricultural Society	61.07	....	42.00	....	141.75	....	...
Wolcott Agricultural Society	....	....	101.00	....	609.35	248.49	
Woodstock Agricultural Society	762.03	340.00	269.10	....	738.40	70.00	

URAL SOCIETIES, 1919.

Salaries	Other Expenses	Cash on Hand	Indebtedness of Society	Real Estate	Personal Property	No. of Members	No. Stockholders	Capital Stock	Admission	Season Tickets	Grand Stand
...	...	...	...	...	...	...	...	...	...	...	...
...	$5.00	$31.10	...	...	...	...	...	...	10c	...	...
20.00	118.25	172.15	...	...	$2.75	...	...	...	...	10-25c	...
...	...	...	...	...	...	...	...	...	...	...	...
15.00	247.22	68.37	...	...	...	151	...	...	...	...	...
50.00	590.85	769.93	...	...	...	...	...	...	...	...	...
15.00	10,608.46	9,148.28	$70,000.00	$202,296.53	8,157.20	...	70	...	50-75c	...	$1.00
...	...	...	...	...	...	650	...	...	...	...	...
20.00	125.00	...	...	...	...	...	...	...	...	...	...
...	422.19	485.32	...	...	...	...	...	...	...	...	...
00.00	6,358.09	561.89	16,690.00	26,000.00	...	193	...	...	25-50c	$2.50	25c
...	13.50	2.67	...	...	...	...	...	...	25c	...	...
30.00	61.68	17.81	60.00	...	...	33	...	...	25c	...	...
25.00	48.68	208.61	...	200.00	250.00	315	...	...	25c	...	...
...	5.00	8.91	...	...	...	143	...	...	...	...	...
...	..60.00	159.03	...	...	...	246	...	...	10-25c	...	...
...	408.03	290.48	...	...	...	5	...	...	25c	...	...
45.00	88.49	259.98	...	...	75.00	41	...	...	15-25c	...	...
25.00	...	685.63	1,000.00	5,000.00	500.00	93	...	$2,000.00	25-35c	...	25c
25.00	38.75	780.49	...	...	400.00	426	...	...	35c	50c	...
...	119.34	148.90	265.40	5,000.00	1,000.00	...	30	2,500.00	15-25c	...	...
60.00	37.21	55.26	300.00	1,800.00	150.00	181	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
5.00	60.20	184.35	...	...	...	120	...	...	15-25c	...	...
...	86.50	46.81	150.00	...	...	...	...	...	10c	...	...
...	368.16	204.67	...	...	...	93	...	...	25-40c	...	...
...	...	15.65	100.00	...	...	...	...	...	...	...	...
...	...	590.29	...	...	...	75	...	...	50c	$1.00	...
...	100.00	32.73	80.00	...	1.00	30	...	...	25c	...	...
55.00	125.00	41.55	...	...	...	...	...	...	...	...	...
...	40.00	...	...	...	...	...	...	...	...	...	...
00.00	537.59	1,128.19	4,000.00	12,000.00	500.00	173	...	...	25-50c	...	...
...	32.64	55.23	...	...	...	152	...	...	25-50c	$1.00	...
...	100.00	4.96	105.00	...	...	...	...	...	15-25c	...	...
25.00	700.00	261.63	...	...	...	...	...	...	30c	...	...
35.36	25.98	62.92	...	...	...	...	...	...	10-15c	...	...
...	21.80	...	...	...	...	...	...	...	...	...	...
...	20.30	454.34	...	...	...	150	...	...	15-35c	...	...
...	44.40	225.54	...	...	158.96	227	...	...	25c	...	...
...	...	17.32	...	...	...	...	...	...	10c	...	...
00.00	1,029.64	59.91									
			...	10,000.00	...	...	125	4,000.00	25-35-50c	$1.00	25-50-75c
12.65	...	...	...	...	...	...	...	...	...	...	...
...	...	...	59.73	...	...	...	...	...	15-25c	...	...
50.00	296.15	788.68	...	25,000.00	...	...	51	5,000.00	25-50c	$1.00	25-50c
...	22.41	...	...	...	...	700	...	...	...	...	...
25.00	1,013.33	99.65	2,000.00	3,000.00	700.00	132	...	...	15-35c	...	...
30.00	122.40	597.41	...	...	...	360	...	...	...	...	...
25.00	121.25	921.01	1,000.00	3,000.00	500.00	140	...	...	25-50c	...	...
...	259.77	...	...	...	...	1504	...	...	10c	...	...
...	...	101.02	700.00	10,000.00	...	30	...	5,000.00	10-15c	...	...
55.00	247.52	1,268.38	...	2,500.00	200.00	550	...	...	35-50c	$1.00	25c
...	10.69	...	...	...	...	594	...	...	...	...	...
...	142.55	79.63	...	...	...	61	...	...	...	...	...
75.00	344.85	...	55.96	4,000.00	100.00	49	...	...	25-50c	...	...
50.00	...	1,009.65	...	...	...	510	...	...	50c	...	25c

ANALYSIS OF PREMIUMS AND GRATUITIES PAID—FARM STOCK, 1918.

Name of Society	Bulls	Milch Cows	Heifers and Calves	Working Oxen (Pair)	Steers (Pair)	Fat Cattle	Horses Except Speed	Horses Speed	Sheep	Swine	Poultry (Coops)	All Other Animals	Total
Avon School Fair Corporation			$10.00							$10.00	$12.00		$32.00
Brookfield School Fair Ass'n.										30.00	3.90	$1.15	35.05
Chester Agri. & Mechanical Society	$3.00	$4.00	5.00	$7.75			$9.25			8.50	30.00	2.25	70.25
Connecticut Bee Keepers' Ass'n.											.40		.40
Connecticut Dairymen's Ass'n.													
Connecticut Fair Association	752.00	1,238.00	612.00					$28.000.00			2,159.50	829.00	33,590.50
Connecticut Pomological Society													
Connecticut Poultry Association													
Connecticut Sheep Breeders' Ass'n.													
Connecticut State Agri. Society	257.00	584.00	88.00	364.00	$78.00	$15.00	32.00		$108.00	25.00	466.00		2,017.00
Coventry Grange Fair Association	7.50	15.75	6.30	22.50	10.50	3.00	9.75				6.75		82.05
Durham Agricultural Fair Ass'n.	27.50	62.50	157.50	40.00	30.00		49.50		5.00	29.50	57.75		459.25
Fairfield County Farm Bureau													
Goshen Agricultural Society	7.50	24.00	10.50	60.00	18.50		32.00		6.00	7.00	85.50		251.00
Granby Agricultural Society	10.00	56.00	48.00	36.00	21.00		37.00	900.00	12.00	9.00	2.48	74.00	1,451.00
Guilford Agricultural Society	6.00	95.50	3.50	57.50	5.50		39.00		23.00	18.00	80.50	71.24	399.74
Haddam Neck Grange Agri. Society	23.75	36.50	62.40	116.00	2.50		13.75		4.10	44.65	2.50	2.50	308.65
Harwinton Agricultural Society	5.50		4.00	39.25	18.75	1.50	22.75				10.50	.50	102.75
Lyme Grange Fair Association	2.00	9.00	4.50	35.00	37.75	5.00	15.00				2.50	2.00	112.75
Mansfield Fair Association	6.00	25.00	26.00	7.00	17.00	2.00	19.50		9.00	15.00	24.55	2.25	153.30
Middlebury Agricultural Society	3.00	9.00	4.50	40.00	4.00		6.00		2.00	11.00	3.75	4.50	51.75
Middlesex County Farm Bureau													
Mt. Carmel Agricultural Society									5.00	21.50	21.50		48.00
New Haven County Farm Bureau													
New London County Agri. Society	121.50	177.00	41.25	21.00	3.50	13.00	83.50	3,820.00	116.50	75.75	129.50	91.00	4,693.50
New London County Imp. League													
Norfolk Agricultural Society	15.00	21.00		95.00	9.50			186.00	11.00	6.00	95.00	22.40	460.90
No. Canaan Agricultural Fair Ass'n.			4.00							6.00	6.00		16.00
No. Stonington Grange Fair	10.75	81.50	28.75	8.00	18.25	3.00	65.00		20.50	26.50	151.25		413.50
Plainfield Garden-Food Club													
Plainville Agricultural Association													

Redding School Fair Association	......	......	2.50	......	......	......	......	......	......	39.50	4.75	.75	47.50
Rockville Fair Association	85.00	182.00	140.00	60.00	19.00	6.00	......	......	34.00	5.00	43.00	......	574.00
Salisbury Association, Inc.	......	......	......	......	......	......	......	......	......	......	......	......	......
Sharon Agricultural Society	......	......	3.00	......	......	......	......	......	......	3.00	4.50	1.50	12.00
Tolland County Farm Bureau	......	......	......	......	......	......	......	......	......	......	......	......	......
Union Agrl. Soc. of Barkhamsted, Colebrook, & Hartland—Riverton	......	......	......	......	......	......	......	......	......	......	......	......	......
Washington Fair Corporation	......	200.00	......	11.00	9.00	......	72.50	......	......	......	26.75	......	319.25
Waterbury Fair Corp. for Pub. Schools	......	......	......	......	......	......	......	......	......	85.00	28.00	......	113.00
Windham County Agricultural Society	54.50	83.00	154.50	41.00	84.00	13.00	103.00	475.00	18.00	10.00	104.25	57.00	1,197.75
Windham County Farmers' Association	......	......	......	......	......	......	......	......	......	......	......	......	......
Windsor Agricultural Society	......	......	......	......	......	......	......	......	......	......	......	......	......
Wolcott Agricultural Society	13.00	35.75	32.00	102.00	33.00	4.50	32.00	......	6.00	14.00	10.00	8.00	290.25
Woodstock Agricultural Society	26.00	114.00	100.00	30.00	53.00	29.00	......	86.00	15.00	10.00	44.25	76.00	583.25

ANALYSIS OF PREMIUMS AND GRATUITIES PAID—FARM STOCK, 1919.

Societies	Bulls	Milch Cows	Heifers and Calves	Working Oxen (Pair)	Steers (Pair)	Fat Cattle	Horses (Ex. Speed)	Horses Speed	Sheep	Swine	Poultry (Coops)	All Other Stock	Total
Avon School Agricultural Society		$10.50	$4.00								$10.25		$24.75
Brookfield School Fair Ass'n.										$1.00	5.55	$2.70	9.25
Chester Agri. & Mechanical Society	$2.00	3.00	4.50	$1.00			$1.50		$1.00	6.50	17.25		36.75
Colchester Grange & School Fair		4.25	4.50	3.50							15.25	6.50	34.00
Connecticut Bee Keepers' Ass'n.											.40		.40
Connecticut Dairymen's Ass'n.													
Connecticut Fair Association, Inc.	618.00	1,172.00	784.00			$600.00		$32,500.00		1,500.00	2,254.00	560.00	39,988.00
Connecticut Pomological Society													
Connecticut Poultry Association													
Connecticut Sheep Breeders' Ass'n.													
Connecticut State Agri. Society	305.00	422.00	98.00	399.00					102.00	39.00	302.00		1,668.00
Cornwall Agricultural Society	4.00	36.00	11.50	15.00			13.00		6.00	6.00	9.50	.50	101.50
Coventry Grange Fair Association	8.25	16.50	15.90	28.00	$9.00		10.50		6.50	4.00	19.50	1.00	119.15
Durham Agricultural Society	52.50	57.50	102.50	125.00	75.00		68.50		2.00	25.00	66.80		574.80
East Haven Fair Association, Inc.									41.00	54.00	20.75	2.75	118.50
Farmington Grange Fair Association	15.00	54.00	29.00				27.00		7.25	25.00		9.75	167.00
Goshen Agricultural Society	9.50	25.50	14.50	37.25	29.25		24.00		7.00	6.00	166.25		319.25
Granby Agricultural Society	42.00	160.00	40.00	65.00	35.50		75.00	1,000.00	15.00	40.00	280.00	28.00	1,775.50
Guilford Agricultural Society	4.50	45.00	3.50	60.00	5.00	8.00	36.00		73.25	16.00	60.00	109.50	415.75
Haddam Neck Grange Agri. Society	36.50	30.75	43.05	118.50	31.50		14.50		13.50	35.00	14.25	1.25	338.75
Harwinton Agricultural Society	10.00	7.25	3.35	55.75	10.00		2.00			4.00	5.00	1.00	98.35
Hebron School Agricultural Society	3.00	2.00	3.50	9.00	2.00		12.50		3.00		12.25	9.50	56.75
Lyme Grange Fair Association		9.00	5.00	40.00	36.50	6.00	17.00				4.00	2.50	120.00
Madison Agricultural Society	2.00	1.50	10.50	23.00	15.00	8.00	16.00		9.00	14.00	12.50	2.00	113.50
Mansfield Fair Association	16.00	25.00	22.50	8.00	19.00	3.00	17.00		7.50	18.00	29.60	1.05	166.65
Marlborough School Agri. Society	3.10	3.95	8.35	3.10	3.10		3.10	3.50			4.45		32.65
Middlebury Agricultural Society	31.00	46.50	15.00	90.00	16.00		21.00		3.00	12.00	12.00	9.50	256.00
Mt. Carmel Agricultural Society													
New Haven County Farm Bureau											100.00		100.00
New London County Agri. Society	87.00	191.50	48.25	68.50	9.25	22.00	62.25		149.50	114.75	307.25	107.50	1,167.75
Norfolk Agricultural Society	14.00	76.50	34.50	37.00	6.00		176.75				67.10	1.50	413.35

o. Canaan Agricultural Fair Ass'n....	......	......	......	......	.....	......	......	....	......	......	......	......	....
o. Stonington Grange Agri. Society...	10.75	105.75	17.50	3.00	.....	......	66.50	....	18.00	28.50	190.00	22.30	462.30
lainfield Garden-Food Club..........	......	......	......	......	.....	......	......	....	......	......	......	4.25	4.25
lainville Agricultural Society........	......	......	......	......	.....	......	......	....	......	......	27.50	......	27.50
lymouth Fair Corporation............	6.00	14.25	10.50	42.00	6.25	......	......	....	2.50	5.00	19.30	2.30	108.10
ortland Hemlock Grange Fair Ass'n...	19.50	64.50	49.75	150.00	89.00	3.00	34.00	....	32.00	8.00	......	......	449.75
..edding Fair Corp. for Public Schools.	......	......	......	......	.....	......	......	....	......	2.75	6.60	2.70	12.05
Rockville Fair Association............	122.00	148.00	226.28	35.00	48.00	6.00	66.00	....	28.00	......	......	......	679.28
The Salisbury Association, Inc.													
Boy's & Girl's Club Exhibition.........	......	......	......	......	.....	......	......	....	......	......	......	......	....
Sharon Agricultural Society...........	......	......	8.00	......	.....	......	......	....	1.00	3.50	4.50	2.00	14.00
Stafford Springs Agricultural Society..	46.00	100.00	97.00	196.00	19.00	12.00	29.00	2,275.00	40.00	18.00	......	......	832.00
Tolland County Farm Bureau..........	......	......	......	......	.....	......	......	....	......	......	......	......	....
Union Agri. Soc. of Barkhamsted, Colebrook, & Hartland—Riverton......	30.00	71.00	72.00	6.00	18.00	......	89.00	....	68.00	18.00	103.75	32.00	452.75
Union Agri. Soc. of Ellington, Enfield, Somers & East Windsor.......	6.00	20.00	19.50	......	.....	......	8.00	....	......	16.00	20.00	......	89.50
Washington Fair Corporation.........	37.00	64.00	69.00	21.50	31.50	......	75.50	....	......	......	168.75	......	467.25
Waterbury Public School Agri. Soc.....	......	......	......	......	.....	......	......	....	......	60.00	33.75	17.25	111.00
Wethersfield Grange Corporation......	......	......	......	......	.....	......	......	....	......	......	......	......	....
Windham County Agricultural Society.	35.50	80.00	155.00	29.00	16.00	11.00	95.00	372.50	18.00	......	121.00	75.50	1,008.50
Windham County Farmers' Association	......	......	......	......	.....	......	......	....	......	......	......	......	....
Windsor Agricultural Society........	......	......	......	......	.....	......	......	....	......	......	......	......	....
Wolcott Agricultural Society..........	17.00	61.50	42.75	67.00	15.00	4.00	11.00	....	11.00	14.00	20.25	45.00	309.50
Woodstock Agricultural Society.......	8.00	30.00	79.00	20.00	94.00	39.25	51.00	340.00	17.00	17.00	90.00	......	445.25

NUMBER OF ANIMALS EXHIBITED, 1918.

Name of Society	Bulls	Milch Cows	Heifers and Calves	Working Oxen (Pair)	Steers (Pair)	Fat Cattle	Horses (Ex-speed)	Horses Speed	Sheep	Swine	Poultry (Coops)	All Other Animals
Avon School Fair Corporation	......	......	15	......	......	......	......	......	......	12	......	......
Brookfield School Agricultural Society	......	......	......	......	......	......	......	......	......	9	9	6
Chester Agricultural & Mechanical Soc.	3	5	6	5	......	......	8	......	......	15	64	5
Connecticut Bee Keepers' Association	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut Dairymen's Association	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut Fair Association, Inc.	34	104	60	......	......	......	......	......	......	......	1200	......
Connecticut Pomological Society	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut Poultry Association	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut Sheep Breeders' Ass'n.	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut State Agricultural Society	40	60	33	83	35	2	6	......	42	10	342	......
Coventry Grange Fair Association	7	12	17	9	5	2	8	......	......	......	14	......
Durham Agricultural Society	8	27	40	50	......	......	......	......	3	40	140	......
Fairfield County Farm Bureau	......	......	......	......	......	......	......	......	......	......	......	......
Goshen Agricultural Society	7	21	15	18	15	......	40	......	11	15	125	......
Granby Agricultural Society	4	27	32	28	16	......	10	41	8	6	250	36
Guilford Agricultural Society	7	82	10	60	6	......	15	......	20	30	100	115
Haddam Neck Grange Agri. Society	10	22	36	91	1	......	15	......	11	24	4	2
Harwinton Agricultural Society	5	......	6	18	27	4	10	......	......	......	14	1
Lyme Grange Fair Association	1	6	5	35	37	4	6	......	......	......	5	10
Mansfield Fair Association	8	15	48	6	14	6	25	......	61	19	63	5
Middlebury Agricultural Society	......	......	......	......	......	......	......	......	......	......	......	......
Middlesex County Farm Bureau	......	......	......	......	......	......	......	......	......	......	......	......
Mt. Carmel Agricultural Ass'n.	......	......	......	......	......	......	......	......	2	20	24	......
New Haven County Farm Bureau	......	......	......	......	......	......	......	......	......	......	......	......
New London County Agricultural Soc.	25	12	106	4	4	5	27	28	65	35	75	......
New London County Imp. League	......	......	......	......	......	......	......	......	......	......	......	......
Norfolk Agricultural Society	7	9	......	30	10	......	......	39	6	3	76	47
No. Canaan Agricultural Fair Ass'n.	......	......	......	......	......	......	......	......	......	......	......	......
No. Stonington Grange Agri. Society	5	42	21	1	5	2	17	......	29	17	150	......
Plainfield Garden-Food Club	......	......	......	......	......	......	......	......	......	......	......	......
Plainville Agricultural Society	......	......	......	......	......	......	......	......	......	......	......	......

Redding Fair Corp. for Pub. Schools			1							7	5	1
Rockville Fair Association	30	95	73	18	9	3			26		10	
Salisbury Ass'n., Inc.												
Sharon Agricultural Society			9							5	12	12
Tolland County Farm Bureau										4		
Union Agrl. Society of Barkhamsted, Colebrook, Hartland—Riverton												
Washington Fair Corporation		37		3	5		23				54	
Waterbury Fair Corp. for Pub. Schools										15	90	
Windham County Agricultural Society	29	50	131	10	29	6	17	17	33	3	260	2
Windham County Farmers' Association												
Windsor Agricultural Society												
Wolcott Agricultural Society	7	22	19	75	18	26	10		6	12	18	21
Woodstock Agricultural Society	26	74	110	10	36	6			8	11		

NUMBER OF ANIMALS EXHIBITED, 1919.

Name of Society	Bulls	Milch Cows	Heifers and Calves	Working Oxen (Pair)	Steers (Pair)	Fat Cattle	Horses (Ex-speed)	Horses Speed	Sheep	Swine	Poultry (Coops)	All Other Animals
Avon School Fair Association	......	6	3	......	......	......	......	......	......	......	12	......
Brookfield School Fair Ass'n.	......	......	......	......	......	......	......	......	......	1	5	10
Chester Agri. & Mechanical Society	2	3	3	1	......	......	2	......	1	4	25	......
Colchester Grange & School Fair	......	5	6	4	......	......	......	......	......	......	35	23
Connecticut Bee Keepers' Association	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut Dairymen's Association	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut Fair Association, Inc.	26	98	72	......	......	52	......	180	......	105	......	......
Connecticut Pomological Society	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut State Poultry Ass'n.	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut Sheep Breeders' Ass'n.	......	......	......	......	......	......	......	......	......	......	......	......
Connecticut State Agricultural Society	36	59	34	35	......	......	......	......	37	14	340	......
Cornwall Agricultural Society	2	15	6	8	......	......	12	......	7	6	15	2
Coventry Grange Fair Ass'n. Inc.	6	16	37	17	8	......	17	......	6	7	31	4
Durham Agricultural Society	20	23	32	31	38	......	31	......	5	......	180	......
East Haven Fair Ass'n. Inc.	......	......	......	......	......	......	5	......	19	47	300	130
Farmington Grange Fair Ass'n.	9	21	18	......	......	......	11	......	8	49	150	......
Goshen Agricultural Society	4	14	8	12	12	......	35	......	6	3	......	......
Granby Agricultural Society	10	43	16	20	8	......	......	......	5	20	178	16
Guilford Agricultural Society	3	29	6	36	3	4	15	......	300	16	126	150
Haddam Neck Grange Agricultural Soc.	10	23	20	67	15	......	18	......	14	28	19	7
Harwinton Agricultural Society	3	7	8	21	15	......	2	......	......	21	9	2
Hebron School Agricultural Society	2	1	6	3	1	......	10	......	2	......	8	10
Lyme Grange Fair Association	......	10	3	40	46	6	8	......	......	......	8	6
Madison Agricultural Society	1	2	7	15	10	2	11	......	6	11	36	7
Mansfield Fair Association	11	10	16	9	18	2	19	......	57	11	76	5
Marlborough School Agri. Society	......	......	......	......	......	......	......	......	......	......	......	......
Middlebury Agricultural Society	......	......	......	......	......	......	......	......	......	......	......	......
Mt. Carmel Agricultural Society	......	......	......	......	......	......	......	......	......	......	......	......
New Haven County Farm Bureau	......	......	......	......	......	......	......	......	......	......	......	......
New London County Agri. Society	12	12	15	13	6	4	7	3	7	8	41	28
Norfolk Agricultural Society	9	30	34	18	10	......	20	......	2	......	98	44

No. Canaan Agricultural Society......	......	......	......	......	......	......	......	......	......	......	......	......
No. Stonington Grange Agri. Society...	7	82	18	1	......	......	20	......	20	31	150	10
Plainfield Garden & Food Club........	......	......	......	......	......	......	......	......	......	......	......	22
Plainville Agricultural Society........	......	......	......	......	......	......	......	......	......	......	25	......
Plymouth Fair Corporation............	3	16	16	13	8	......	......	......	3	4	31	7
Portland Hemlock Grange Fair Ass'n...	4	31	31	49	24	4	26	......	22	15	......	......
Redding Fair Corp. for Public Schools.	......	......	......	......	......	......	......	......	......	3	18	8
Rockville Fair Association............	48	65	105	14	28	2	27	......	29	......	......	......
Boy's & Girl's Club Exhibition												
Salisbury Association, Inc............	......	......	......	......	......	......	......	......	......	......	......	......
Sharon Agricultural Society...........	......	......	4	......	......	......	......	......	1	8	12	7
Stafford Springs Agri. Society.........	11	34	53	48	12	13	......	......	......	......	......	......
Tolland County Farm Bureau...........	......	......	......	......	......	......	......	......	......	......	......	......
Union Agri. Soc. of Barkhamsted, Colebrook & Hartland—Riverton......	9	33	47	2	5	......	19	......	40	7	124	44
Union Agri. Soc. of Ellington, Enfield, Somers & East Windsor.......	2	8	22	......	......	......	......	......	......	......	......	......
Washington Fair Corporation.........	24	32	54	2	19	......	33	......	......	......	254	......
Waterbury Public School Agri. Soc.....	......	......	......	......	......	......	......	......	......	24	92	60
Wethersfield Grange Corporation......	......	......	......	......	......	......	......	......	......	......	......	......
Windham County Agricultural Soc.....	16	57	107	6	11	8	21	10	33	......	239	......
Windham County Farmers' Association	......	......	......	......	......	......	......	......	......	......	......	......
Windsor Agricultural Society..........	......	......	......	......	......	......	......	......	......	......	......	......
Wolcott Agricultural Society..........	9	27	39	36	13	9	5	......	6	5	39	4
Woodstock Agricultural Society.......	2	24	50	10	49	15	......	......	......	......	107	......

ATTENDANCE AT AGRICULTURAL EXHIBITS, 1918.

Name of Society	Place	Date	Attendance						
			Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total
Avon School Fair Corp.	Avon	Sept. 21						500	500
Brookfield School Fair Ass'n.	Brookfield	Oct. 2			400				400
Chester Agri. & Mechan. Soc.	Chester	Sept. 27					950		950
Conn. Bee-Keepers' Assn.	Hartford	Sept. 2-6							25,000
Conn. Dairymen's Assn.	Hartford								
Conn. Fair Association	Hartford	Sept. 2, 3, 4, 5, 6	54,000	11,000	12,000	15,000	10,000		102,000
Conn. Pomological Society	Hartford								
Conn. Poultry Association	Hartford								
Conn. Sheep Breeders' Assn.	Hartford								
Conn. State Agricultural Society	Berlin	Sept. 24-28		2,000	3,000		9,000	2,000	16,000
Coventry Grange Fair Assn.	Coventry	Sept. 25			400				400
Durham Agri. Society	Durham	Oct. 2			5,000				5,000
Fairfield County Farm Bureau	Danbury	Jan. 15-16, 1919			250	300			550
Goshen Agricultural Society	Goshen	Sept. 2	3,500						3,500
Granby Agricultural Society	Granby	Oct. 2-3			900	2,700			3,600
Guilford Agricultural Society	Guilford	Sept. 25			6,000				6,000
Haddam Neck Grange Agri. Soc.	Haddam Neck	Sept. 2	1,756						1,756
Harwinton Agri. Society	Harwinton	Oct. 8		7,000					7,000
Lyme Grange Fair Assn.	Lyme	Sept. 18			1,500				1,500
Mansfield Fair Assn.	Mansfield	Sept. 24						600	600
Madison Agri. Society	Madison	Sept. 17							
Middlebury Agri. Society	Middlebury	Sept. 27					400		400
Middlesex County Farm Bureau	Middletown	Dec. 20				325			325
Mount Carmel Agri. Society	Mount Carmel	Sept. 21						600	600
New Haven County Farm Bureau	New Haven	Dec. 12, 13, 14							700
New Haven C. Hort. Society	New Haven	Sept. 11-12			1,500	1,200			4,000
New London Co. Agri. Society	Norwich	Sept 2-3-4	14,000	5,000	1,000				20,000
New London Co. Imp. League	Norwich	Dec. 11-12-13		25	125	100			250
Norfolk Agri. Society	Norfolk	Sept. 6-7					563	1,296	1,859
No. Canaan Agri. Fair Assn.	No. Canaan	Sept. 18							150
No. Stonington Grange Agri. Soc.	No. Stonington	Sept. 17-20		100	800	2,500	100		3,500
Plainfield Garden-Food Club	Plainfield	Sept. 21							200
Plainville Agri. Society	Plainville	Sept. 20-21					500	700	1,200
Redding Fair Corp. for Pub. Schools	Redding	Sept. 30	300						300
Rockville Fair Association	Rockville	Sept. 17-21		452			4,541	261	5,264

Salisbury Association, Inc.	Salisbury	Aug. 31	......	......	......	......	......	......	......
Sharon Agri. Society	Sharon	Sept. 30	......	......	......	......	......	......	......
Tolland County Farm Bureau	Rockville	......	......	......	......	......	......	......	......
Washington Fair Corporation	Washington	Sept. 6	......	......	......	......	3,500	......	3,500
Waterbury Fair Corp. for Pub. Schools	Waterbury	Sept. 23-24-25	6,000	7,000	7,000	......	......	......	20,000
Windham Co. Agri. So.	Brooklyn	Sept. 25-26	......	......	4,000	500	......	......	4,500
Windham Co. Farmers' Assn.	Putnam	Nov. 21	......	......	......	......	300	......	300
Windsor Agri. Society	Windsor	Oct. 12	......	......	......	......	200	600	800
Wolcott Agri. Society	Wolcott	Oct. 2	......	......	1,600	......	......	......	1,600
Woodstock Agri. Soc.	Woodstock	Sept. 17	......	3,500	......	......	......	......	3,500

ATTENDANCE AT AGRICULTURAL EXHIBITS, 1919.

Name of Society	Place	Date	Attendance						
			Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total
Avon School Fair Association	Avon	Sept. 20	......	......	......	......	500	......	500
Brookfield School Fair Association	Brookfield	Oct. 4	......	......	......	......	......	300	300
Chester Agricultural & Mechanical Soc.	Chester	Sept. 26	......	......	......	......	1200	......	1200
Colchester Grange & School Fair	Colchester	Sept. 17	......	......	400	......	......	......	400
Connecticut Bee-Keepers' Association	Hartford	Sept. 1-5	......	......	......	......	......	......	25,000
Connecticut Dairymen's Association	Hartford	Jan. 22, 23, 24	......	......	......	......	......	......	......
Connecticut Fair Association	Hartford	Sept. 1, 2, 3, 4, 5	60,000	......	......	20,000	12,000	......	92,000
Connecticut Pomological Society	Hartford	Jan. 20-24	......	......	......	......	......	......	......
Connecticut Poultry Association	......	......	......	......	......	......	......	......	......
Connecticut Sheep Breeders' Assn.	......	......	......	......	......	......	......	......	......
Connecticut State Agri. Society	Berlin	Sept. 22-27	500	500	4,000	12,000	5,000	3,000	25,000
Cornwall Agricultural Society	Cornwall	Sept. 26	......	......	......	......	396	......	396
Coventry Grange Fair Assn., Inc.	Coventry	Sept. 17	......	......	500	......	......	......	500
Durham Agricultural Fair Association	Durham	Oct. 1	......	......	5,000	......	......	......	5,000
East Haven Fair Association, Inc.	East Haven	Sept. 13	......	......	......	......	......	3,500	3,500
Farmington Grange Fair Association	Farmington	Oct. 1	......	......	876	......	......	......	876
Goshen Agricultural Society	Goshen	Sept. 1	3,700	......	......	......	......	......	3,700
Granby Agricultural Society	Granby	Oct. 1, 2, 3	......	......	900	300	2,100	......	3,300
Guilford Agricultural Society	Guilford	Sept. 24	......	......	6,000	......	......	......	6,000
Haddam Neck Grange Agri. Ass'n.	Haddam	Sept. 1	1,800	......	......	......	......	......	1,800
Harwinton Agricultural Society	Harwinton	Oct. 7	......	7,000	......	......	......	......	7,000
Hebron School Agricultural Society	Hebron	Sept. 26	......	......	......	350	......	......	350
Lyme Grange Fair Association	Lyme	Sept. 17	......	......	2,500	......	......	......	2,500
Madison Agricultural Society	Madison	Sept. 17	......	......	1,000	......	......	......	1,000
Mansfield Fair Association	Mansfield	Sept. 26, 27	......	......	......	......	350	600	950
Marlborough School Agricultural Soc.	Marlborough	Sept. 20	......	......	......	......	......	150	150
Middlebury Agricultural Society	Middlebury	Sept. 12, 13	......	......	......	......	700	1,300	2,000
Mt. Carmel Agricultural Society	Mt. Carmel	Sept. 27	......	......	......	......	......	250	250
New Haven County Farm Bureau	New Haven	Feb. 2, 3, 4	800	675	721	630	......	......	2,826
New Haven County Horticultural Soc.	New Haven	Sept. 30, Oct 1	......	2,000	2,000	......	......	......	4,000
New London County Agricultural Soc.	Norwich	Sept. 1, 2, 3	11,000	4,000	500	1,000	......	......	16,500
Norfolk Agricultural Society	Norfolk	Sept. 5, 6	......	......	......	......	665	1,276	1,941
North Canaan Agricultural Fair Ass'n.	North Canaan	Oct. 8	......	......	......	......	......	......	200
North Stonington Grange Fair	North Stonington	Sept. 16, 17, 18	......	200	3,000	800	......	......	4,000
Plainfield Garden & Food Club	Plainfield	Sept. 20	......	......	......	......	120	......	120

Plainville Agricultural Society.........	Plainville	Sept. 12, 13....	......	......	......	......	250	250	500
Plymouth Fair Corporation............	Plymouth	Oct. 11........	......	......	......	......	......	1,300	1,300
Portland Hemlock Grange Fair Ass'n.	Portland	Sept. 13........	......	......	......	2,500	......	......	2,500
Redding Fair Corp. for Public Schools.	Redding	Sept. 27........	......	......	......	......	......	250	250
Rockville Fair Association............	Rockville	Sept. 10, 11, 12.	......	......	1,657	3,248	1,049	......	5,954
Salisbury Ass'n. Inc., Boys' & Girls' Garden Clubs Exhibition	Salisbury	Aug. 30........	......	......	......	......	......	......	......
Sharon Agricultural Society...........	Sharon	Aug. 28........	......	......	......	320	......	......	320
Stafford Springs Agricultural Society..	Stafford Springs..	Oct. 15, 16, 17.	......	......	5,000	9,000	4,000	......	18,000
Tolland County Farm Bureau..........	Rockville	Jan. 7........	......	......	60	......	......	......	60
Union Agri. Society of Barkhamsted, Colebrook & Hartland, Inc.—Riverton	Riverton	Oct. 11........	......	......	......	......	......	5,000	5,000
Union Agri. Soc. of Ellington, Enfield, Somers and East Windsor...........	Ellington	Oct. 1........	......	......	......	......	......	......	......
Washington Fair Corporation.........	Washington	Sept. 5........	......	......	......	......	3,500	......	3,500
Waterbury Public School Agri. Society	Waterbury	Sept. 23, 24, 25	......	1,580	1,503	1,619	......	......	4,702
Wethersfield Grange Corporation......	Wethersfield	Oct. 1, 2.......	......	......	350	400	......	......	750
Windham County Agricultural Society.	Brooklyn	Sept. 23, 24, 25	......	......	4,500	1,000	......	......	5,500
Windham County Farmers' Association	Putnam	Nov. 20.......	......	......	......	100	......	......	100
Windsor Agricultural Society.........	Windsor	Oct. 10, 11.....	......	......	......	......	250	350	600
Wolcott Agricultural Society..........	Wolcott	Oct. 2, 3.......	......	......	......	500	1,200	......	1,700
Woodstock Agricultural Society.......	Woodstock	Sept. 17.......	......	......	3,355	......	......	......	3,355

REPORT OF THE TREASURER.

Chas. A. Thompson in account with

STATE BOARD OF AGRICULTURE.

			Dr.	Cr.
1918				
Oct.	1	Balance amount in treasury	$ 1,959.56	
Nov.	4	Hotel Bond	$	9.35
1919				
Jan.	8	L. H. Healey		469.22
“	“	MacDonald & Williams		88.94
“	“	Hallie G. Root		45.00
“	“	N. Howard Brewer		16.32
“	“	Eleanor B. Armor		17.00
“	“	John G. Brash		100.00
“	“	American Plant Pest Committee		15.00
“	“	Hartford Printing Company		6.00
“	“	Bill Brothers		3.39
“	“	Estate of J. H. Blakeman		3.72
“	“	George W. Burch		1.00
“	“	Southern New England Telephone Co.		3.95
“	“	John M. Klein		1.50
“	29	Garde Hotel		77.45
Feb.	7	State Appropriation	$ 1,000.00	
“	“	S. G. McLean		7.00
“	“	A. D. Clark		8.00
“	“	H. L. Hamilton		12.00
“	“	E. P. & E. L. Barnes		10.00
“	“	Fred Thorpe		5.00
“	“	W. A. Simpson		5.00
“	“	Charles Whitaker		3.00
“	“	Edward W. Hazen		5.00
“	“	A. C. King		3.00
“	“	Elliott H. Benton		2.00
“	“	Wilcox Brothers		2.00
“	“	Mrs. F. P. Lewis		3.00
“	“	A. Vaill Smith		3.00

Feb.	7	F. W. Martin	2.00
"	"	E. W. Dwyer	5.00
"	"	L. C. Spencer	3.00
"	"	S. P. Griswold	5.00
"	"	J. B. McLean	3.00
"	"	Fred Sturges	2.00
"	"	Geo. C. West	3.00
"	"	C. S. Hyde	2.00
"	"	Oliver K. Driggs	3.00
"	"	H. H. Tomlinson	2.00
"	"	Joel G. Hawley & Sons	3.00
"	12	S. Howard Peckham	2.00
"	"	Howard Zabriski	9.22
"	"	Louis Marschat	6.41
"	"	David Kaufman	11.80
"	"	William O'Hear	10.19
"	"	Maurice Blick	10.29
"	"	Merrill Healey	15.88
"	"	Mason Parker	14.38
"	"	E. B. Davis	7.37
"	"	Harold Stewart	6.18
"	"	Harold Eastwood	8.29
"	"	Jean E. Jones	10.00
"	"	Winifred Jones	10.00
"	"	Emerson B. Davis	8.60
"	"	Camilla Neilson	9.15
"	"	James F. O'Leary	9.15
"	"	David Kaufman	12.35
"	"	Paul Kaufman	10.75
"	"	L. M. Johnson	10.00
"	"	Alex. Smith Corn Club	10.00
"	"	Cash paid for railroad fares	100.00
"	21	L. H. Healey	29.95
"	"	R. A. Gooch	5.00
"	"	Eleanor Ball Armor	62.00
"	"	Hallie G. Root	18.00
"	"	Plimpton Mfg. Co.	5.25
"	"	Earl Jones	3.96
"	"	State Comptroller (Telephone)	7.85

Feb.	26	The Garde Hotel		152.10
“	“	A. J. Brundage		3.26
“	“	MacDonald & Williams		6.15
“	“	Evans Brothers		6.35
Mar.	12	J. G. Brash, Treasurer, Farmers' Week Committee		200.00
“	26	J. G. Brash, Treasurer, Farmers' Week Committee		100.00
Apr.	8	Clifford Benson		5.27
“	9	Frank Stayton		15.00
“	24	L. H. Healey		428.79
“	“	Hallie G. Root		27.00
“	“	Eleanor Armor		80.00
“	“	E. E. Brown		30.75
“	“	State Comptroller (Telephone)		13.05
“	“	MacDonald & Williams		13.44
“	25	H. T. Hyde & Co.		9.90
“	“	A. L. Klunker		6.00
“	“	Bill Brothers Co.		5.14
“	“	Hotel Bond		18.90
“	“	C. A. Thompson		19.60
May	1	Putnam Patriot		38.45
“	“	State Comptroller (Telephone)		4.40
June	18	State Appropriation ....$	1,625.00	
“	26	Harold Eastwood		5.00
“	30	L. H. Healey		469.84
“	“	Gustave Fischer Co.		38.45
“	“	L. H. Healey		55.00
“	“	American Plant Pest Committee (Postals)		40.00
“	“	Hotel Bond		18.90
“	“	H. P. Deming		16.36
“	“	Hallie G. Root		30.00
“	“	MacDonald & Williams		166.36
“	“	Remington Typewriter		1.10
“	“	Eleanor B. Armor		106.00
“	“	Pierce Incorporated		21.25
“	“	State Comptroller (Telephone)		4.90
“	“	Calhoun Press		3.75

June	30	Rourke Eno Paper Company		5.00
"	"	J. B. Palmer		26.75
"	"	C. A. Thompson		80.37
"	"	C. R. Treat		5.52
"	"	F. E. Blakeman		46.12
"	"	W. H. Lee		2.38
"	"	State Comptroller (Deficiency Appropriation) ....$	600.00	
"	"	C. F. Spencer		3.00
"	"	E. E. Brown		43.85
"	"	F. B. Bishop		3.62
"	"	C. L. Butler		3.54
"	"	R. D. Bristol		3.50
"	"	C. C. Watrous		3.00
"	"	F. J. Seaton		4.00
"	"	L. A. Bevan		4.02
"	"	Mrs. Allan Clark		2.15
	"	Frank A. Waters		2.15
"	"	S. P. Humphrey		2.98
"	"	John H. Root		2.98
"	"	A. A. McLeod		.44
"	"	Charles Brainard		1.14
"	"	B. W. Tinker		1.80
"	"	Robert Mitchell		.44
"	"	Edward V. Conley		1.80
"	"	A. L. Reed		1.02
"	"	H. B. Pomeroy		1.02
"	"	H. S. Coe		2.04
"	"	J. G. Schwink Jr.		1.28
"	"	Charles M. Jarvis		.64
"	"	George M. Sampson		3.66
"	"	L. M. Johnson		4.02
Balance amount in treasury		....		1,377.01
			$ 5,184.56	$ 5,184.56

We have this day examined the accounts of Chas. A. Thompson, treasurer, and find the same correct.

C. R. TREAT,
N. HOWARD BREWER,

Hartford, Conn., July 1, 1919. *Auditors.*

Report of the Treasurer.

CHAS. A. THOMPSON in account with

STATE BOARD OF AGRICULTURE.

1919.			Dr.	Cr.
July	1	Balance amount in treasury	$ 1,377.01	
Aug.	8	State Comptroller		$ 2.80
"	"	MacDonald & Williams		83.97
"	11	State Comptroller		3.67
"	19	State Comptroller		2.55
Sept.	29	J. G. Brash	$ 12.80	
Oct.	1	H. C. C. Miles	109.56	
"	3	State Comptroller	500.00	
"	"	State Comptroller	1,223.08	
Sept.	29	Wilson H. Lee		18.52
"	"	Hotel Bond		21.85
"	"	L. H. Healey		410.45
"	"	F. S. Chapman		44.74
"	"	F. E. Blakeman		21.45
"	"	H. P. Deming		26.00
"	"	Chas. R. Treat		25.12
"	"	Putnam Patriot		19.83
"	"	Karmi Kimberly		33.46
Oct.	3	Edward A. Marks		5.05
"	"	A. Pindar Corp.		2.00
"	"	H. V. Beebe		4.00
"	"	L. H. Healey		153.90
"	"	Brainard Nursery & Seed Co.		202.65
"	"	The Whitall Electric Co.		162.64
"	"	J. Douglas Law Co.		9.91
"	"	J. C. Eddy		22.50
"	"	H. G. Cook		3.00
"	"	MacDonald & Williams		200.00
"	"	H. O. Daniels		88.50
"	"	S. P. Hollister		29.07
"	"	A. Pindar Corp.		19.63
"	"	Eastern States Exposition		19.20
"	"	Springfield Lumber Co.		65.69
"	"	Barnes Bros.		24.50
"	"	C. P. Chase & Co.		17.28

Oct.	3	H. C. C. Miles		56.85
“	“	Geo. V. Smith		58.81
“	“	A. E. Plant Son's Co.		18.00
“	“	Miller & Stoddard		15.00
“	“	S. A. Shepard		12.00
“	“	T. H. & L. C. Root		12.50
“	“	State Comptroller		9.07
“	31	L. H. Healey		60.00
“	“	W. H. Baldwin		21.00
“	“	Gulley & Son		10.50
“	“	Forbes & Wallace		44.25
“	“	S. R. MacDonald		7.50
“	“	W. F. Platt		30.00
“	“	S. P. Hollister		15.00
“	“	C. L. Terrell		15.00
“	“	Elijah Rogers		15.00
“	“	H. L. Garrigus		21.50
“	“	Chas. G. Billings		30.25
“	“	W. A. Sheehan		10.00
“	“	H. F. Baldwin		6.00
Nov.	7	Springfield Union		3.30
“	“	State Comptroller		6.95
Dec.	9	State Comptroller		7.70
“	15	J. M. Whittlesey		200.00
1920				
Jan.	2	Hotel Bond		17.75
“	“	L. H. Healey		451.56
“	“	State Comptroller		3.80
“	“	James B. Palmer		33.30
“	“	Remington Typewriter Co.		4.80
“	“	MacDonald & Williams		81.40
“	“	State Comptroller	$ 176.39	
“	“	Hartford Printing Co.		6.00
“	“	Putnam Patriot		15.50
“	“	Willis A. Dean		5.50
“	“	Library Bureau		9.00
“	“	Chas. B. Cox		5.00
“	“	Griswold Greenhouse Co.		14.00
“	“	P. A. Sears		16.80
“	“	L. H. Healey		187.50

Jan.	28	State Comptroller	$ 19.00	
Feb.	20	State Comptroller	1,000.00	
"	"	The Garde		196.15
Mar.	6	Harry Bond		70.35
"	"	Putnam Patriot		80.86
"	12	L. H. Healey		120.64
"	"	Plimpton Mfg. Co.		12.85
"	"	F. E. Blakeman		36.78
"	"	Neostyle Sales Agency		17.90
"	"	J. M. Whittlesey		8.08
"	"	The Bulletin Co.		125.00
"	"	Gutsave Fischer Co.		15.50
"	"	Earl Jones		19.87
"	"	H. W. Dubois & Co.		33.00
"	"	G. O. Simons, Inc.		1.80
"	"	Remington Typewriter Co.		1.25
"	"	Bill Bros.		7.31
"	"	J. M. Whittlesey	$ 23.56	
"	"	Norman S. Platt	50.00	
"	16	Conn. Dairymen's Association	50.00	
"	"	Hartford Weekly Guide		1.00
"	26	E. F. Richardson		23.56
"	"	A. M. Griffin		5.00
"	"	F. B. Nangle		13.00
"	"	J. T. McKnight		12.00
"	"	J. E. Lord		5.00
"	"	F. A. Barnes		3.00
"	"	J. B. & E. F. Parker		2.00
"	"	W. A. Lauterman		5.00
"	"	C. W. Roberts		3.00
"	"	Vine Hill Farm Co.		2.00
"	"	H. L. Hamilton		37.00
"	"	P. J. Rourke		6.00
"	"	James Warner		5.00
"	"	S. G. McLean		2.00
"	"	F. C. Barbour		3.00
"	"	C. E. Hill		2.00
"	"	E. W. Dyer & Son		20.00
"	"	Oliver J. Thrall		15.00

Mar.	12	Nathaniel Jones		30.00
"	"	Horace S. McKnight		35.00
"	"	Nicholas Glennon		15.00
"	"	L. W. Marsh		10.00
"	"	Merrill Healey		50.00
"	"	John Bahler		25.00
"	"	Walter H. Johnson		10.00
Apr.	7	The Garde		7.50
"	"	L. H. Healey		528.63
"	"	Case, Lockwood & Brainard Co.		15.55
"	"	G. O. Simons		6.00
"	14	A. Pindar Corp.		53.87
"	"	Wise, Smith & Co.		4.68
"	"	Steiger Vedder Co.		44.93
"	"	Chas. A. Thompson		167.00
"	"	W. J. Warner		6.92
"	"	Bill Bros.		2.51
"	"	L. H. Healey		25.00
May	10	State Comptroller		11.75
Apr.	26	State Comptroller	$ 1,000.00	
May	12	Hotel Arrigoni		14.90
"	17	Chas. R. Treat		60.72
"	"	Bill Bros. Co.		5.90
"	"	Gustave Fischer Co.		1.60
"	27	Lester C. Alvord		6.85
"	"	Oscar Warner		11.77
"	"	Thomas Quinn		10.70
"	"	Fred Congdon		11.78
"	"	Hyman Guterman		8.90
"	"	Ernest Skilton		5.00
June	25	State Comptroller	$ 3,500.00	
"	"	Calhoun Show Print		128.55
"	"	Patriot Press		546.00
"	"	J. B. Palmer		11.15
"	26	State Comptroller		12.70
"	"	State Comptroller	$ 674.55	
"	"	L. H. Healey		642.08
"	"	J. B. Palmer		6.65
"	"	N. Howard Brewer		16.00

June	26	W. F. Miller & Co.		3.00
"	"	F. E. Blakeman		12.00
"	"	Gustave Fischer Co.		6.45
"	"	C. B. Jewett		2.75
"	"	Patriot Press, Inc.		94.43
"	"	C. A. Thompson		55.67
"	"	H. P. Deming		20.54
"	"	F. S. Chapman		19.30
"	"	Philo T. Platt		25.51
"	"	Margaret J. Noonan		17.32
"	"	Hotel Bond		21.55
Balance amount in treasury				2,743.42
			$ 9,715.95	$ 9,715.95

We have this day examined the accounts of Chas. A. Thompson, treasurer, and find the same correct.

N. H. BREWER,
J. B. PALMER,
C. R. TREAT,
Auditors.

Hartford, Conn., July 1, 1920.

CONNECTICUT DAIRYMEN'S ASSOCIATION.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Dairymen's Association for the year ending December 31st, 1918, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand	$ 774.16
Record Sheets	52.36
Memberships	119.00
Donations	300.00
Premium Fund	350.00
Sale of butter	20.27
Floor Space Rental	285.00
State appropriation	839.25
Miscellaneous	20.45
	$ 2,760.49

EXPENDITURES.

Annual meeting	$ 687.00
Premiums	688.54
Directors' and Officers' expenses	156.78
Secretary's salary	250.00
Institute meetings	8.54
Printing	745.09
Miscellaneous	2.16
Cash to balance	222.38
	$ 2,760.49

Attest: DWIGHT J. MINOR, *Secretary.*

CONNECTICUT DAIRYMEN'S ASSOCIATION.

List of Officers for the year ending December 31, 1918.

OFFICERS:

President	C. B. POMEROY, Willimantic
Vice-president	ROBERT MITCHELL, Southbury
Treasurer	R. E. BUELL, Wallingford
Secretary	DWIGHT J. MINOR, Bristol

DIRECTORS:

R. J. AVERILL	Washington Depot
H. L. GARRIGUS	Storrs
H. O. DANIELS	Middletown
THOMAS HOLT	Newington
VICTOR LUCCHINI	Meriden
GERALD WALDO	Scotland
E. J. HEMPSTEAD, JR.	New London
J. ARTHUR SHERWOOD	Long Hill

CONNECTICUT DAIRYMEN'S ASSOCIATION.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Dairymen's Asciation for the year ending December 31st, 1919, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand Dec. 1, 1918	$	222.38
Record sheets		43.77
Memberships		121.00
Donations		225.00
Premium Fund		350.00
Sale of Butter		25.50
State appropriation		1,666.75
Miscellaneous		13.70
	$	2,668.10

EXPENDITURES.

Annual meeting	$	536.71
Premiums		657.00
Secretary's salary		150.00
Officers' expenses		168.96
Printing		380.00
State Fairs' Association dues		5.00
Balance on hand Dec. 1, 1919		769.93
	$	2,668.10

Attest: DWIGHT J. MINOR, *Secretary.*

CONNECTICUT DAIRYMEN'S ASSOCIATION.

List of Officers for the year ending December 31, 1919.

OFFICERS:

President	ROBERT MITCHELL, Southbury
Vice-President	JOSEPH ALSOP, Avon
Treasurer	M. E. PIERPONT, Waterbury
Secretary	DWIGHT J. MINOR, Bristol

DIRECTORS:

R. J. AVERILL	Washington Depot
H. L. GARRIGUS	Storrs
J. ARTHUR SHERWOOD	Long Hill
H. O. DANIELS	Middletown
GERALD WALDO	Willimantic
VICTOR LUCCHINI	Meriden
F. E. DUFFY	West Hartford
I. E. CROUCH	Groton
C. B. POMEROY	Willimantic

CONNECTICUT POMOLOGICAL SOCIETY.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Pomological Society for the year ending February 1st, 1919, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand	$ 292.74
Memberships	722.00
State Appropriation	1,164.25
Exhibit space rental	98.00
Sale of fruit	485.63
Agricultural Fair Fund	600.00
Miscellaneous	48.44
	$ 3,411.06

EXPENDITURES.

Expenses of Annual meeting	$ 784.89
Premiums paid at annual meeting	337.75
Publishing annual report	539.63
Expenses of fall exhibition	47.24
Field meetings	20.25
Secretary's salary and office expenses	615.72
Treasurer's office expenses	5.00
Miscellaneous printing, stationery and postage	174.74
Exhibit at Farmers' Week	359.89
Meetings at Farmers' Week	501.08
Sundry expenses	14.25
Cash on hand	10.42
	$ 3,411.06

Attest, H. C. C. MILES, *Secretary.*

CONNECTICUT POMOLOGICAL SOCIETY.

List of Officers for the Year Ending January, 1919.

OFFICERS:

President	W. H. BALDWIN, Cheshire
Vice-President	PROF. ALVA T. STEVENS, Storrs
Secretary	H. C. C. MILES, Milford
Treasurer	HAROLD M. ROGERS, Southington

DIRECTORS:

Hartford County	LEWIS C. ROOT, Farmington
New Haven County	ARTHUR N. FARNHAM, Westville
Fairfield County	P. G. SEXTON, Darien
Litchfield County	H. G. HALLOCK, Washington Depot
New London County	F. W. BROWNING, Norwich
Middlesex County	E. D. WATROUS, Middlefield
Windham County	DR. G. P. PERLEY, Woodstock
Tolland County	C. H. SAVAGE, Storrs

CONNECTICUT POMOLOGICAL SOCIETY.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Pomological Society for the year ending February 10th, 1920, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand Feb. 17, 1919	$ 10.42
Memberships	248.00
State Appropriation a/c year 1918	443.57
State Appropriation a/c year 1919	1,717.16
Sale of fruit	58.76
Agricultural Fair Fund	100.00
	$ 2,577.91

EXPENDITURES.

Balance of Expenses Farmers' Week Meetings & Exhibit	$ 179.92
Premiums awarded at Farmers' Week Meetings & Exhibit	656.50
Premiums paid at annual meeting, 1919	87.19
Publishing annual report	378.50
Field Meetings	46.16
Expenses of fall exhibitions	71.80
Premiums of fall exhibitions	359.50
Secretary's salary and office expenses	443.90
President's office expenses	41.57
Treasurer's office expenses	20.86
Miscellaneous printing, stationery and postage	40.85
Exhibit at Eastern States Exposition	96.80

Publicity Committee	17.83
Sundry expenses	50.00
Balance on hand	86.52
	$ 2,577.91

Attest, H. C. C. MILES, *Secretary.*

CONNECTICUT POMOLOGICAL SOCIETY.

List of Officers for year ending January, 1920.

President	ALVA T. STEVENS, Storrs
Vice-President	H. G. HALLOCK, Washington Depot
Secretary	H. C. C. MILES, Milford
Treasurer	HAROLD M. ROGERS, Southington

DIRECTORS:

Hartford County	LEWIS C. ROOT, Farmington
New Haven County	MARK BISHOP, Cheshire
Fairfield County	GEORGE A. DREW, Greenwich
Litchfield County	CHARLES L. GOLD, West Cornwall
New London County	F. W. BROWNING, Norwich
Middlesex County	PAUL P. WILCOX, Durham
Windham County	DR. G. P. PERLEY, Woodstock
Tolland County	W. C. ROBINSON, Columbia

CONNECTICUT POULTRY ASSOCIATION.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Poultry Association for the year ending January 21st, 1919, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand	$ 800.00
Memberships	174.00
State appropriation	1,000.00
State fair fund	100.00
	$ 2,074.00

EXPENDITURES.

Directors' expenses	$ 123.45
Premiums paid at annual meeting	102.50
Field meeting	224.50
Annual meeting	345.80
Miscellaneous	291.50
Printing and postage	69.95
Secretary's salary	120.00
Balance on hand	796.30
	$ 2,074.00

Attest, GEORGE V. SMITH, *Secretary.*

CONNECTICUT POULTRY ASSOCIATION.

List of Officers for the Year Ending January, 1919.

OFFICERS:

President	PAUL P. IVES, Guilford
Secretary	GEORGE V. SMITH, W. Willington
Treasurer	CHAS. H. BRUNDAGE, Danbury
Attorney	CHAS. F. ROBERTS, New Haven

COUNTY VICE-PRESIDENTS:

Hartford County	T. M. SAVAGE, Berlin
New Haven County	E. K. JUDD, Montowese
New London County	L. E. BILL, Clark's Falls
Fairfield County	P. G. SEXTON, Darien
Windham County	GERALD WALDO, Willimantic
Litchfield County	F. F. STEVENS, Canaan
Middlesex County	C. L. BLISS, Middletown
Tolland County	W. H. BUMSTEAD, Stafford Springs

EXECUTIVE COMMITTEE:

Hartford County	MRS. F. A. THOMPSON, Hartford
New Haven County	JOHN E. KNECHT, New Haven
New London County	E. W. BROWN, Old Mystic
Fairfield County	A. B. BRUNDAGE, Danbury
Windham County	A. P. ABBE, Willimantic
Litchfield County	H. P. DEMING, Winsted
Middlesex County	J. L. PAYNE, Portland
Tolland County	MADISON WOODWARD, Columbia

AT LARGE:

D. E. PARMELEE	Durham
S. G. McLEAN	So. Glastonbury
MYRON W. OSBORN	So. Norwalk

AUDITORS:

CHAS. I. BALCH	Manchester
HARRISON L. HAMILTON	Ellington

CONNECTICUT POULTRY ASSOCIATION.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Poultry Association for the year ending January 1st, 1920, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand	$ 741.40
Memberships	174.00
Memberships	154.00
State appropriation	1,000.00
State fair fund	100.00
	$ 2,169.40

EXPENDITURES.

Directors' expenses	$ 148.30
Premiums paid at annual meeting	126.50
Field meeting	100.45
Annual meeting	134.80
Miscellaneous	389.60
Printing and postage	231.00
Secretary's salary	120.00
Balance on hand	918.75
	$ 2,169.40

Attest, PAUL P. IVES, *Secretary*

Connecticut Poultry Association.

List of Officers for the Year Ending February 10th, 1920.

OFFICERS:

President	W. K. KIRKPATRICK, Storrs
Secretary	PAUL P. IVES, New Haven
Treasurer	CHAS. H. BRUNDAGE, Danbury
Attorney	CHAS. F. ROBERTS, New Haven

County Vice-Presidents:

Hartford County	T. M. SAVAGE, Berlin
New Haven County	E. K. JUDD, Montowese
New London County	L. E. Bill, Clark's Falls
Fairfield County	P. G. SEXTON, Darien
Windham County	GERALD WALDO, Willimantic
Litchfield County	F. F. STEVENS, Canaan
Middlesex County	J. L. PAYNE, Portland
Tolland County	W. H. BUMSTED, Stafford Springs

Executive Committee:

Hartford County	L. J. ROBERTSON, Hartford
New Haven County	J. E. KNECHT, New Haven
New London County	E. W. BROWN, Old Mystic
Fairfield County	A. B. BRUNDAGE, Danbury
Windham County	A. P. ABBE, Willimantic
Litchfield County	H. P. DEMING, Winsted
Middlesex County	C. L. BLISS, Middletown
Tolland County	MADISON WOODWARD, Columbia

At Large:

PAUL P. IVES	Guilford
S. G. McLEAN	So. Glastonbury
R. E. JONES	Storrs

Auditors:

CHAS I. BALCH	Manchester
H. L. HAMILTON	Ellington

Connecticut Sheep Breeders' Association.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Sheep Breeders' Association for the year ending December 1st, 1918, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand	$ 112.28
Membership	50.50
State appropriation	946.47
	$ 1,109.25

EXPENDITURES.

Annual meeting	$ 78.90
Shearing contest	50.38
Premiums and bounties	254.50
Printing	78.35
Institute expenses	65.87
Speakers	76.84
Officers' and directors' expenses	129.62
Miscellaneous	48.34
Balance on hand	326.45
	$ 1,109.25

Attest, H. L. Garrigus, *Secretary.*

Connecticut Sheep Breeders' Association.

List of Officers for the Year Ending December, 1918.

OFFICERS:

President	CHAS. L. GOLD, West Cornwall
Vice-President	HENRY DORRANCE, Plainfield
Secretary	H. L. GARRIGUS, Storrs
Treasurer	B. C. PATTERSON, New London

DIRECTORS:

Hartford County	H. W. ANDREWS, Suffield
New Haven County	D. M. MITCHELL, South Britain
New London County	JAMES B. PALMER, Norwich
Fairfield County	ROBERT GREEN, Brookfield Center
Windham County	RAY BLIVEN, South Canterbury

Litchfield County ....W. L. PENTECOST, Taconic
Middlesex County ....C. D. MANWARING, Clinton
Tolland County .JOHN WALBRIDGE, Rockville, R. F. D.

CONNECTICUT SHEEP BREEDERS' ASSOCIATION.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Sheep Breeders' Association for the year ending December 1st, 1919, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand	$ 326.45
Membership	98.00
State appropriation	802.06
	$ 1,226.51

EXPENDITURES.

Annual meeting	$ 69.26
Shearing contest	99.00
Premiums and bounties	220.00
Printing	55.52
Officers' and directors' expenses	211.06
Miscellaneous	86.35
Balance on hand	485.32
	$ 1,226.51

Attest, H. L. GARRIGUS, *Secretary.*

CONNECTICUT SHEEP BREEDERS' ASSOCIATION.

List of Officers for the Year Ending December 31st, 1920.

President ....HENRY DORRANCE, Plainfield
Vice-President ......H. D. CHITTENDEN, Crescent Beach
Secretary ....H. L. GARRIGUS, Storrs
Treasurer ....B. C. PATTERSON, New London

DIRECTORS:

Hartford County ....H. F. CHISHOLM, Hartford
New Haven County ......D. M. MITCHELL, South Britain

New London County	E. C. GREY, No. Stonington
Fairfield County	PERCY C. FOOTE, Bridgeport
Windham County	HENRY HOPKINS, Plainfield
Litchfield County	W. L. PENTECOST, Taconic
Middlesex County	C. D. MANWARING, Clinton
Tolland County	JOHN WALBRIDGE, Rockville

CONNECTICUT BEE-KEEPERS' ASSOCIATION.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Bee-Keepers' Association for the year ending December 31st, 1918, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand	$ 94.62
State appropriation	300.00
State fair fund	200.00
Loan	249.23
Dues	134.73
Miscellaneous	30.18
	$ 1,008.76

EXPENDITURES.

Premiums	$ 512.25
Loan	350.00
Gleanings in Bee Culture	49.92
Secretary's office	15.50
Printing and postage	10.50
Judge at fair	25.00
Watchman at fair	18.00
Balance on hand	27.59
	$ 1,008.76

Attest, L. WAYNE ADAMS, *Secretary.*

CONNECTICUT BEE-KEEPERS' ASSOCIATION.

List of Officers for the Year Ending December 31, 1919.

President ....REV. D. D. MARSH, West Hartford
Vice-President ....HENRY L. LANKTON, Wethersfield
Secretary and Treasurer,
L. WAYNE ADAMS, 15 Warner Street, Hartford

CONNECTICUT BEE-KEEPERS' ASSOCIATION.

FINANCIAL STATEMENT.

A financial statement of the Connecticut Bee-Keepers' Association for the year ending December 31st, 1919, made to L. H. Healey, Secretary of the State Board of Agriculture.

RECEIPTS.

Cash on hand	$	27.59
State appropriation		300.00
State fair fund		200.00
Dues		233.50
	$	761.09

EXPENDITURES.

Premiums	$	514.50
Loan		50.00
Gleanings in Bee Culture		107.00
Secretary's office		15.00
Printing and Postage		43.72
Conn. State Fair Association		5.00
Miscellaneous		7.50
		742.72
Cash on hand		18.37
	$	761.09

Attest, LOUIS ST. CLAIR BURR, *Secretary.*

CONNECTICUT BEE-KEEPERS' ASSOCIATION.

List of Officers for the Year Ending January, 1920.

President ....REV. D. D. MARSH, West Hartford
Vice-President ....HENRY L. LANKTON, Wethersfield
Secretary and Treasurer,
L. WAYNE ADAMS, 15 Warner Street, Hartford

OFFICERS
—OF—
CONNECTICUT STATE GRANGE
1919.

FRANK E. BLAKEMAN, Master	Oronoque
ALLEN B. COOK, Overseer	Middlebury
CHARLES A. WHEELER, Lecturer	Storrs
MINOR IVES, Steward	South Meriden
LOUIS G. TOLLES, Asst. Steward	Southington
REV. J. H. HOYT, Chaplain	New Canaan
N. S. PLATT, Treasurer, 395 Whalley Ave.	New Haven
ARD WELTON, Secretary	Plymouth
WILLIAM F. CLARK, Gate-Keeper	Lyme
MRS. RUTH T. RANDALL, Ceres	Bridgewater
MISS TALULAH SIKES, Pomona	Suffield
MRS. WALTER S. HINE, Flora	Orange
MRS. MAY K. TAYLOR, Lady Steward	Lebanon

EXECUTIVE COMMITTEE:

L. H. HEALEY, No. Woodstock	1920
CHARLES T. DAVIS, Middletown	1921
J. ARTHUR SHERWOOD, Long Hill	1922
FRANK E. BLAKEMAN, Oronoque	1919
ARD WELTON, Plymouth	1919

AUDITING COMMITTEE.

H. C. DUNHAM, Middletown, H. S. BLAKE, New Britain
IRVING E. CROUCH, Groton.

LEGISLATIVE COMMITTEE.

F. E. DUFFY, West Hartford H. D. SIKES, Suffield
EVERETT E. BROWN, Pomfret Center.

PUBLICITY COMMITTEE.

C. A. WHEELER, Storrs MRS. G. B. EDDY, Avon
HAROLD B. WALDO, Glastonbury.

BOARD OF ARBITRATION.

Executive Committee, Overseer, Lecturer

GENERAL DEPUTY.

ALLEN B. COOK, Middlebury.

DEPUTIES FOR POMONA GRANGES:

Central No. 1, SHERMAN W. EDDY ....Avon
Quinebaug No. 2, FRANK K. HAINES ....Pomfret Center
East Central No. 3, LUTHER C. SKINNER ......Rockville
Mountain Co. No. 4, EDWIN J. BUSBY ....Winsted
New Haven Co. No. 5, H. J. BROCKETT ......Clintonville
New London Co. No. 6, E. F. WHITE ....North Stonington
Excelsior No. 7, ARTHUR F. GREENE ....Middlebury
Sea View No. 8, ROBERT S. BAILEY .....East Hampton
Fairfield Co. No. 9, A. B. BRUNDAGE ....Danbury
Housatonic Val. No. 10, FRANK H. PEET ....Kent

JUVENILE DEPUTY:

MRS. SUSIE G. WILLIAMS ....Brooklyn

HOME ECONOMICS COMMITTEE:

MRS. WALLACE N. MITCHELL ....Newtown

PATRONS' MUTUAL FIRE INSURANCE COMPANY:

HENRY E. LOOMIS, President ....Glastonbury
J. ARTHUR SHERWOOD, Vice-President .....Long Hill
W. H. CARRIER, Treasurer ....Glastonbury
H. C. DUNHAM, Secretary ....Middletown

EXECUTIVE COMMITTEE:

President, Secretary, Treasurer and
W. H. BALDWIN, Cheshire H. W. TREAT, Bridgewater
Annual Meeting in January.

PATRONS' EXCHANGE:

WALTER S. HINE, President ....Orange

OFFICERS OF THE GRANGES, 1919.

NAME	No.	MASTER	LECTURER	SECRETARY
POMONA GRANGES				
Central Pomona	1	Myron N. Case, Portland	Mrs. Jessie M. Griswold, Rocky Hill	Mrs. E. B. Adams, Berlin
Quinebaug Pomona	2	Franklin H. Bennette, Ashford	George H. Hamilton, R. D. 2, Putnam	Mrs. Susie G. Williams, Brooklyn
East Central Pomona	3	Donald Johnson, Wapping	Mrs. Kate Carrier, Glastonbury	Mrs. Laura J. Brewer, East Hartford
Mountain County Pomona	4	Ard Welton, Plymouth	Mrs. Ida E. W. Davis, Collinsville	H. P. Deming, Winsted
New Haven County Pomona	5	Clyde Dickinson, Westville	Miss Grace E. White, Guilford	Miss Daisy G. Howell, Guilford
N. London County Pomona	6	E. Frank White, North Stonington	Rev. G. F. Goodenough, Norwich	Alice A. Bishop, R. D. 9, Norwich
Excelsior Pomona	7	Chas. Moshier, Waterbury, R. D. 2	B. S. Johnson, Bethlehem	Jessie C. Perry, Union City
Sea View Pomona	8	J. Warren Stark, Lyme	Miss Annie Smith, Chester	Myron G. Skinner, Higganum
Fairfield County Pomona	9	Mrs. M. L. Lacey, Bridgeport, R. D. 52	Frank S. Bailey, R. D. 5, Danbury	Mrs. Nellie E. Blakeman, Oronoque
Housatonic Valley Pomona	10	W. M. Curtiss, New Milford	H. W. Treat, Bridgewater	Mrs. Adele P. Brush, West Cornwall
SUBORDINATE GRANGES				
Washington	11	Herbert G. Hallock, Washington Depot	Mrs. Kate Bruens, Washington Depot	Frederic J. Ford, Washington Depot
Tunxis	13	Fred M. Mansur, Bloomfield	Mrs. Sarah Campbell, Bloomfield	Miss Annie M. Christensen, Blomfield
Hope	20	Kerrill K. Kimberly, Torrington, R. D.	Wm. R. Kohrs, Torrington	W. L. Benton, Torrington
Lebanon	21	Fred M. Abell, Lebanon	Mrs. Bernice Fowler, Lebanon	Fred N. Taylor, Lebanon
Cheshire	23	Howard F. Baldwin, Cheshire	Mrs. Clifford Terrell, Cheshire	Mrs. Howard W. Durand, Cheshire
Berlin	24	George J. Reed, Berlin	Miss Alberta L. Elton, Berlin	Mrs. E. B. Adams, Berlin
Union	25	Ernest Smart, Southington, R. D.	Mrs. J. G. Raymond, R. D., Southington	Austin S. Chaffee, Milldale
Glastonbury	26	Wm. H. Carrier, Glastonbury	Louis W. Howe, South Glastonbury	George W. Andrews, Glastonbury
Suffield	27	Miss Talulah M. Sikes, Suffield	Mr. George B. Parks, Suffield	Mrs. Hermina Spaulding, Suffield
Meriden	29	David H. Yale, Meriden	Minor Ives, South Meriden	Mrs. M. A. Francis, Wallingford
Wapping	30	Edward P. Collins, Wapping	Lucius V. Platt, R. D. Broad Brook	Mrs. Hattie E. Johnson, Wapping
Manchester	31	John McLaughlin, South Manchester	Helen Chedelf, Manchester	Mrs. L. G. Loomis, South Manchester
Cornwall	32	F. E. Baldwin, West Cornwall	Mrs. A. M. Clark, R. D., Litchfield	Mrs. Adele P. Brush, West Cornwall
Wallingford	33	Emerson J. Leonard, Wallingford	Mrs. A. M. Williams, Wallingford	Miss Florence H. Harrison, Wallingford
Cawasa	34	Lewis Case, R. D., Collinsville	Mrs. Mae A. Daggett, Canton Center	Mrs. Annette E. Case, Canton
No. Haven	35	Horace I. Brockett, New Haven	Mrs. A. H. Carlson, North Haven	Mrs. Mabel H. Thorpe, North Haven
Little River	36	Ray Baker, Hampton	Mrs. Angie M. Burnham, Hampton	Mrs. Mabel Pearl, Hampton
East Hartford	37	R. A. Hall, Silver Lane	Mrs. Amelia Foley, East Hartford	Mrs. Amy Spencer, Hartford
New Canaan	38	J. Howard Hoyt, D. D., New Canaan	Mrs. Carrie T. Jelliff, New Canaan	Mrs. Mary C. Tunney, New Canaan
Burritt	39	John Johnson, New Britain	Miss Elizabeth Crandall, New Britain	Mrs. F. H. Sharpe, New Britain
Senexet	40	Windsor F. Clark, R. D. 2, Putnam	George H. Hamilton, R. D. 2, Putnam	Mrs. Louisa Clark, R. D. 2, Putnam

OFFICERS OF THE GRANGES, 1919—Continued.

NAME	MASTER	LECTURER	SECRETARY
Subordinate Granges—Continued			
Konomoc 41	Ezra J. Hempstead, Waterford	Mrs. Bessie Daniels, Waterford	Miss Alice L. Baker, New London
Mattabessett 42	Clifton W. Kelsey, Middletown R. D. 2	Miss Edith M. Birdsey, Middletown	C. Marsden Bacon, Middletown
Brooklyn 43	Miss Helen L. Witter, Brooklyn	Mrs. Susie G. Williams, Brooklyn	Leslie W. Havens, Brooklyn
Newington 44	Kent E. Stoddard, Newington Junction	Edward B. Meyers, Newington Junction	Lillian B. Francis, Newington
Harwinton 45	Lewis Reynolds, R. D. 2, Torrington	Miss Ethel Balch, R. D. 2, Torington	Mrs. Lizzie Wilson, R. D. 2, Torrington
Ellington 46	Howard H. McKnight, R. D., Ellington	John E. Gifford, Ellington	Charles R. Thrall, Ellington
Bolton 47	Fred Finley, Bolton	Miss Mary Mathein, Bolton	Miss Annie M. Alvord, Bolton
Whigville 48	E. A. Matthews, Bristol	Miss Ella Winston, Bristcl	Charles A. Matthews, Bristol
Farmington 49	Arthur J. Birdseye, Farmington	Harry C. Mills, Unionville	Miss G. McKinney, R. D., Farmington
Westfield 50	F. E. Boardman, Middletown	Mrs. A. W. Gilbert, Middletown	Miss Madeline Smith, Middletown
Tolland 51	Ivan F. Wilcox, Merrow	Mrs. Ellen B. West, R. D. 4, Rockville	Mrs. E. W. Gunther, R. D. 2, Rockville
Vernon 52	Lewis T. Skinner, R. D. 3, Rockville	Mrs. Blanche L. Templeton, Rockville	Miss Helen K. Sill, Rockville
Plainville 54	Harold L. Newell, Plainville	Mrs. H. P. Lowrey, Plainville	Mrs. Harold L. Newell, Plainville
Stafford 55	J. M. Larned, R. D. 2, Stafford Springs	Mrs. Ruth Gary, Stafford	Miss Isadore Dunham, Stafford
East Haddam 56	Robert W. Bingham, Jr., East Haddam	Miss Lauretta Plumley, East Haddam	Miss M. E. Countryman, East Haddam
Durham 57	Harold Hall, Durham Center	A. Ernest Otte, Durham Center	Mrs. Julius Rich, Durham
West Hartford 58	Bayard D. York, Hartford	Miss Daisy T. Day, Hartford	H. J. Miller, West Hartford
Wolf Den 61	Willis Covell, Abington	Mrs. Emma Ransom, Pomfret Center	C. L. Ransom, Pomfret Center
Eureka 62	Bernard G. Anderson, New Hartford	Miss M. T. Anderson, New Hartford	Mrs. Chas. R. Brown, New Hartford
Middlefield 63	E. A. Trischman, Rockfall	Miss Lucy Andrews, Middlefield	Mrs. Blanche Dudley, Rockfall
Mansfield 64	Lester E. Card, Storrs	Grace H. Kirkpatrick, Storrs	Mrs. Myra Crane, Storrs
Quinnatisset 65	Charles F. Whiting, Webster, Mass.	Mrs. Annie K. Barton, Thompson	Mrs. Hannah W. Bates, Thompson
Killingworth 66	Herman Heser, R. D., Clinton	Herbert C. Stevens, R. D., Clinton	Mrs. Grace L. Everts, R. D., Madison
Cromwell 67	John H. Broderick, Cromwell	Mrs. Jessie Broderick, Cromwell	Miss Lottie M. Sage, Cromwell
Natchaug 68	Mrs. Myrtie C. Lanphear, Chaplin	Mrs. Julia A. Moran, North Windham	Frank C. Lummis, Chaplin
Shetucket 69	Russell Waldo, R. D., Willimantic	Mrs. Merle Waldo, R. D., Willimantic	Mrs. Martha Moffitt, Scotland
Canterbury 70	Mrs. L. M. Frink, R. D. 1, Canterbury	Mrs. C. L. Hawes, R. D. 1, Canterbury	Levi N. Clark, R. D. 1, Canterbury
Mad River 71	Harry Buckingham, Waterbury	Dorothy Miller, R. D. 1, Waterbury	Bessie D. Parks, Waterbury
Plymouth 72	E. Nelson Canfield, R. D. Thomaston	Miss Edith Sutliffe, Plymouth	Miss Iva M. Lumpkin, Plymouth
Indian River 73	H. C. C. Miles, Milford	John B. Hubbard, West Haven	Albert N. Beard, Milford
Winchester 74	Albert M. Dayton, R. D., Torrington	Lena Pendleton, R. D., Winsted	Fred S. Beecher, Winchester
Coventry 75	Arthur L. Reed, R. D. 2, Rockville	Mrs. Constance Fiske, R. D. 2, Rockville	Mrs. Agnes Hall, R. D. 2, Rockville
Andover 76	Frank L. Hamilton, Andover	Edward M. Yeomans, Andover	Mrs. Marjorie Bartlett, Andover
Clinton 77	Miss Marion Miller, Clinton	Mrs. Eliza E. McGhee, Clinton	Albert M. Buell, Clinton

OFFICERS OF THE GRANGES, 1919 — Continued.

NAME	MASTER	LECTURER	SECRETARY
Subordinate Granges—Continued			
Colchester 78	Clayton G. Miller, Colchester	Elmer H. Foote, Colchester	Belle L. Strong, Colchester
Housatonic 79	George H. Tomlinson, Oronoque	Marion Meachen, Stratford	Nathan E. Wells, Stratford
Guilford 81	F. Harold Butler, R. D., Guilford	Mrs. A. F. Blatchley, R. D., Guilford	Miss Daisy G. Howell, Guilford
Colebrook 82	Arthur B. Ferry, R. D. 1, Winsted	Mrs. Alice Gilman, R. D. 2, Winsted	Miss Madeline G. Smith, Colebrook
Totoket 83	Nathan A. Harrison, Branford	Miss Lucy R. Holabird, Branford	Mrs. Alice B. Miller, Branford
Foxen 84	Maurice Bailey, East Haven	Carrie Goodrich, East Haven	Gladys Hotchkiss, Branford
Webutuck 86	R. K. Woodward, Sharon	N. Collins Smith, Amenia, N. Y.	Mrs. F. R. Rundall, Amenia, N. Y.
Hillstown 87	Forest N. Buckland, Glastonbury	Mrs. Jennie Brown, Glastonbury	Harry J. Brewer, Glastonbury
Ekonk 89	Thomas A. Brown, R. D. 1, Moosup	Miss G. G. Gallup, R. D. 1, Moosup	Mrs. P. E. Gallup, R. D. 1, Moosup
Ashford 90	Alex M. Bassett, Warrenville	Frank H. Bennett, Ashford	Mrs. Addie S. Bassett, Warrenville
Seymour 91	Pasquale Ajello, R. D. 2, Seymour	Miss Mary Hull, R. D. 2, Seymour	Mrs. E. F. Francis, R. D. 2, Seymour
Harmony 92	Mrs. M. L. Lacey, R. D. 1, Bridgeport	Miss Lillian I. Lewis, Stepney Depot	Clarence B. Burr, Stepney Depot
East Windsor 94	Alfred F. Potwine, Warehouse Point	Mrs. Alena Allen, Warehouse Point	Mrs. M. Potwine, Warehouse Point
Pachaug 96	Merton Bartlett, Griswold	Mrs. Grace Bartlett, Griswold	Miss Ola Tanner, Voluntown
Putnam 97	Mrs. Dorothy J. Bartlett, Putnam	Miss Marjorie C. Bradford, Putnam	Mrs. Elsie C. Johnson, Putnam
Taghhannuck 100	Mrs. Alida C. Buckley, Amenia, N. Y.	Mrs. Ardella Thorp, Sharon	Miss Marjorie Hand, Sharon
Mashapaug Lake 101	L. M. Reed, Stafford Springs	Ella C. Barrows, Stafford Springs	Nelson E. Horton, Stafford Springs
Beacon Valley 103	Elmer Tucker, R. D. 2, Naugatuck	Mrs. Idella Tucker, R. D. 2, Naugatuck	Mrs. D. B. Sanford, R. D. 2, Naugatuck
Somers 105	A. S. Hurlbut, Somers	Mrs. Myrtle Bellville, Somers	Mrs. Elmira Galbraith, Somers
Litchfield 107	Joseph D. Coffill, Litchfield	Miss Ruth E. Smith, R. D. 1, Litchfield	Leroy R. Sanford, R. D. 2, Litchfield
Woodbridge 108	Edward A. Hitchcock, Westville	Mrs. Elinore Cabot, Westville	Leroy C. Beecher, Westville
East Hampton 109	A. J. Vingoe, East Hampton	Mrs. Grace Goff, East Hampton	Mrs. Ola M. West, East Hampton
Preston City 110	Nathan Hunt Hall, R. D. 3, Norwich	Chas. C. Zabriskie, R. D. 1, Norwich	Mrs. Alice D. Hall, R. D. 3, Norwich
Hebron 111	Hart E. Buell, R. D. 2, Andover	J. Banks, R. D. 2, Andover	Mrs. Mary G. Buell, R. D. 2, Andover
Killingly 112	Walter F. Day, R. D., Killingly	Frank L. Bennett, R. D., Killingly	Miss Annie L. Page, Danielson
Highland 113	Louis S. Barstow, R. D., Killingly	Mrs. Ida M. Tillinghast, R. D., Danielson	Jacob L. Spaulding, R. D., Danielson
Wethersfield 114	L. Wayne Adams, Hartford	Miss Mary R. Segur, Wethersfield	Miss J. L. Stevenson, Wethersfield
Rocky Hill 115	Louis W. Button, Rocky Hill	Mrs. Mary W. Hall, Rocky Hill	Mrs. Lillian M. Backe, Rocky Hill
Bristol 116	Charles P. Bacon, Bristol	Miss Mary H. Mills, Bristol	Miss Gertrude M. Kelsey, Bristol
Unity 117	Mrs. Mabel La Place, Deep River	Mrs. Arabella Beebe, Deep River	Mrs. Helen L. Stevens, Deep River
Beacon 118	Robert A. Goodwin, R. D. 2, Litchfield	Geo. H. Peck, Waterbury	Charles S. Hulme, Thomaston
Morris 119	Vernon A. Raymond, R. D., Bethlehem	Miss E. Twing, R. D., Thomaston	A. Ernest Anderson, East Morris
Bethlehem 121	Walter P. Lake, Bethlehem	Joseph P. Banks, Bethlehem	Mrs. Edna G. M. Hayes, Bethlehem

OFFICERS OF THE GRANGES, 1919 — Continued.

NAME	MASTER	LECTURER	SECRETARY
Subordinate Granges—Continued			
Watertown 122	Irving F. Smith, Watertown	Rev. C. E. Wells, Watertown	A. F. Copeland, R. D. 1, Thomaston
Higganum 124	Myron G. Skinner, Higganum	Mrs. Richard J. Johnson, Higganum	Everett E. Kahrman, Higganum
Hollenbeck 125	Walter I. Kellogg, Falls Village	Mrs. William Shepard, Falls Village	Mrs. Levi Ganser, Falls Village
Good Will 127	Leon R. Bidwell, Glastonbury	Mrs. Jennie V. Waldo, Glastonbury	Harold B. Waldo, Glastonbury
Pohtatuck 129	George L. Clark, Sandy Hook	Mrs. Edith W. G. Mitchell, Newtown	Miss Charlotte C. Minor, Newtown
Farmill River 130	Olin Shelton, R. D. 7, Shelton	George Arundell, R. D. 8, Shelton	Mrs. H. Brockway, R. D. 3, Bridgeport
Columbia 131	Luther Buell, Columbia	Mrs. Ethel Blakeley, Columbia	Raymond E. Clarke, Columbia
Wichita 132	John Angevine, New Preston	Miss Rose Breen, Cornwall Bridge	Louise Chappins, Cornwall Bridge
Greenfield Hill 133	W. Burr Hill, R. D. 9, Fairfield	Mrs. Alice M. C. Hill, R. D. 9, Fairfield	Miss N. B. Wilson, R. D. 9, Fairfield
Trumbull 134	H. F. Randall, R. D. 3, Bridgeport	Mrs. Alice Landon, Long Hill	Ella E. Rogers, R. D. 4, Bridgeport
Silver Lake 135	E. Franklin Byron, Sharon	Mrs. F. L. Bristol, Sharon	Miss Evelyn D. Scott, Sharon
East Canaan 136	D. M. Green, Canaan	J. C. Stevens, R. D., Canaan	Clara M. Bottum, East Canaan
Willington 137	Mrs. J. E. Nichols, West Willington	Mrs. G. V. Smith, West Willington	Miss H. G. Nichols, West Willington
No. Stonington 138	Philip E. Gray, North Stonington	Miss Ruby R. Park, North Stonington	E. Frank White, North Stonington
Middlebury 139	Albert G. Clark, Middlebury	Mrs. A. F. Greene, Middlebury	Florence C. Clark, Middlebury
Plainfield 140	William S. Exley, Plainfield	Miss Ella J. Gardiner, Plainfield	Mrs. Evelyn A. Hall, Plainfield
Rock Rimmon 142	Mrs. Mary R. Clark, Beacon Falls	Mrs. May C. Bowe, Beacon Falls	Miss R. M. Carroll, Beacon Falls
Goshen 143	Garry A. Miles, Goshen	A Committee suggested	Miss Louise E. Wright, Goshen
Prospect 144	A. S. Talmadge, R. D. 2, Waterbury	Mrs. D. Talmadge, R. D. 2, Waterbury	Miss Sarah Blackman, Waterbury
Rippowam 145	Henry M. Chrissey, R. D. 29, Stamford	J. H. Bedell, Stamford	Miss Dorothy Horner, Stamford
Norfield 146	J. D. Sturdevant, R. D. 12, Westport	Clarence Shipman, R. D. 42, Norwalk	George D. Gifford, R. D. 42, Norwalk
Lyme 147	Arthur G. Sweet, Lyme	Mrs. Sadie Roberts, Hadlyme	Mrs. Ida H. Lee, Lyme
Easton 149	Stephen Barmore, Bridgeport	Willard Gillette, Long Hill	Mrs. Lora H. Andrews, Long Hill
Enfield 151	Marshall Collins, Hazardville	John Suddy, Hazardville	Harry J. Bridge, Hazardville
Cannon 152	James O'Donnell, Cannondale	Rev. J. Howard Fairchild, Canondale	Mrs. L. R. Ambler, Cannondale
Bridgewater 153	Carl Olson, Bridgewater	Miss Frederica Starr, Bridgewater	Miss Mary J. Hatch, New Milford
Kent 154	William E. Templeton, Kent	Hugh G. Mosher, R. D., Kent	Miss May Chamberlin, Kent
Danbury 156	A. B. Brundage, R. D. 4, Danbury	Chas. H. Brundage, R. D. 1, Danbury	Frank H. Bailey, R. D. 5, Danbury
Chester 158	Frank Sypher, R. D., Deep River	Elizabeth H. Smith, Chester	Marguerite J. Goken, Chester
Salisbury 159	Geo. A. Selleck, Salisbury	Mrs. Elizabeth Cooper, Salisbury	F. Gertrude Miner, Lakeville
Aspetuck Valley 160	William Becker, South Kent	Mrs. William Becker, South Kent	Miss Rebecca Hotchkiss, New Milford
Bozrah 161	Charles B. Davis, R. D., Yantic	Mrs. Emma Davis, R. D., Yantic	Mrs. Ethel M. Eastland, Fitchville
Old Lyme 162	Earl Morgan, Old Lyme	Mrs. Myra Morgan, Old Lyme	Mrs. J. Maude Ashley, Old Lyme
Redding 163	William Grouse, Redding	Mrs. Florence Grouse, Redding	Miss Ella Ostling, Redding

OFFICERS OF THE GRANGES, 1919—Continued.

NAME	MASTER	LECTURER	SECRETARY
Subordinate Granges—Concluded			
Bethel 164	Henry C. Staib, Bethel	Mrs. Katherine Wixted, Bethel	Mrs. Actie Judd, Newtown
Ridgefield 165	Arthur W. Northrop, Bridgefield	Mrs. Anna Northrop, Ridgefield	Frederick D. Thomas, Ridgefield
Salem 166	Chas. E. Malona, R. D. 3, Colchester	Mrs. C. B. Hanney, R. D. 4, Colchester	Mrs. H. M. Malona, R. D. 3, Colchester
Ledyard 167	Billings T. Avery, R. D. 6, Norwich	Rev. G. F. Goodenough, R. D. 6, Norwich	Mrs. Ursula Avery, R. D. 6, Norwich
Stonington 168	Fred A. Barnes, Mystic	Miss Hattie Wheeler, Stonington	Miss Natalie S. Hazard, Westerly, R. I.
Riverton 169	Fred B. Appel, Riverton	A. L. Lewis, Riverton	Mrs. Jessie E. Coe, Riverton
Wemanesa 170	W. B. Hungerford, Gaylordsville	Mrs. Mary Feeley, Gaylordsville	Mrs. J. M. Hungerford, Merwinsville
Mystic 171	L. O. Allen, Mystic	Miss Sara Gookin, Mystic	Clarence Coogan, Mystic
Norwich 172	John R. Lyman, East Great Plain	Miss Hazel Banfield, Norwich	Mrs. Lila J. Saunders, Norwich
Wolcott 173	Charles Nelson Cole, R. D. 2, Bristol	Miss E. Warner, R. D. 1, Waterbury	Mrs. E. A. Norton, R. D. 4, Waterbury
Torringford 174	Edson Davis, R. D. 3, Torrington	Grove K. Johnson, R. D. 3, Torrington	Mrs. E. Hopkins, R. D. 3, Torrington
Lake Valley 175	W. H. Worden, R. D. 1, Gaylordsville	Ella K. Beyer, R. D. 1, Gaylordsville	Mrs. Jennie M. Worden, R. D. 1, Gaylordsville
Groton 176	I. E. Crouch, Groton	Mrs. Ellen B. Barber, Groton	Miss Amanda Allen, Groton
Haddam Neck 177	L. J. Selden, R. D., East Hampton	C. G. Crocker, Middle Haddam	Mrs. E. G. Clark, R. D., East Hampton
Avon 179	C. B. Hadsell, Avon	Mrs. Arthur Ewing, Avon	Dorothy Manion, Avon
Echo 180	Harold Storrs, Eagleville	D. C. Flaherty, Eagleville	Abbie O. Storrs, Eagleville
Meadow Brook 181	Henry M. Downing, No. Windham	Mrs. Emma Hibbard, No. Windham	Mrs. Carrie E. Hayden, No. Windham
Hemlock 182	Wm. C. Stocking, Portland	Mrs. Lephe Hale, Gildersleeve	William B. Synnott, Portland
Darien 183	Henry B. Cook, Darien	Dr. John Godfrey, Darien	Byron H. Cantrell, Darien
Franklin 184	Milton F. Beckwith, R. D. 2, Yantic	Mrs. Nettie T. Race, No. Franklin	Miss C. C. Holton, No. Franklin
Pomperaug 185	Samuel E. Cook, Southbury	Mrs. Florence Hicock, Southbury	Mrs. Mary E. Mallory, Southbury
Shelton 186	Mrs. Isabelle Colvin, Shelton	Mrs. Verna Perry, Shelton	Mrs. Emma C. Wakelee, Shelton
Hartland 187	Adolph Goetz, West Hartland	Mrs. Mae Le Geyt, Barkhamsted	Mrs. H. E. Gaylord, West Hartford
Bethany 188	Wallace S. Saxton, R. D. Bethany.	Mrs. Bertha H. Kinney, New Haven	Arthur H. Kinney, New Haven

OFFICERS
—OF—
CONNECTICUT STATE GRANGE
1920.

FRANK E. BLAKEMAN, Master	Oronoque
ALLEN B. COOK, Overseer	Middlebury
CHARLES A. WHEELER, Lecturer	Storrs
MINOR IVES, Steward	South Meriden
LOUIS G. TOLLES, Asst. Steward	Southington
REV. J. H. HOYT, Chaplain	New Canaan
N. S. PLATT, Treasurer, 395 Whalley Ave.	New Haven
ARD WELTON, Secretary	Plymouth
WILLIAM F. CLARK, Gate-Keeper	Lyme
MRS. RUTH T. RANDALL, Ceres	Bridgewater
MISS TALULAH SIKES, Pomona	Suffield
MRS. WALTER S. HINE, Flora	Orange
MRS. MAY K. TAYLOR, Lady Steward	Lebanon

EXECUTIVE COMMITTEE:

CHAS. T. DAVIS, Middletown	1921
J. ARTHUR SHERWOOD, Long Hill	1922
L. H. HEALEY, No. Woodstock	1923
FRANK E. BLAKEMAN, Oronoque	1920
ARD WELTON, Plymouth	1920

FINANCE COMMITTEE:

H. C. DUNHAM, Middletown. SHERMAN W. EDDY, Avon
ROBERT SINCLAIR, Stepney Depot

LEGISLATIVE COMMITTEE.

E. E. BROWN, Pomfret Center. H. D. SIKES, Suffield
F. E. DUFFY, West Hartford.

PUBLICITY COMMITTEE.

C. A. WHEELER, Storrs, H. B. WALDO, Glastonbury
MRS. EMORY P. SANFORD, West Redding.

BOARD OF ARBITRATION.

Executive Committee, Overseer, Lecturer

GENERAL DEPUTY.

HOWARD D. SIKES .... Suffield

DEPUTIES FOR POMONA GRANGES:

Central No. 1, MYRON N. CASE .... Portland
Quinebaug No. 2, FRANK K. HAINES .... Pomfret Center
East Central No. 3, LUTHER C. SKINNER ...... Rockville
Mountain Co. No. 4, EDWIN J. BUSBY .... Winsted
New Haven Co. No. 5, PAUL HOTCHKISS ...... Cheshire
New London Co. No. 6, E. F. WHITE .... North Stonington
Excelsior No. 7, ARTHUR F. GREENE .... Middlebury
Sea View No. 8, ROBERT S. BAILEY ..... East Hampton
Fairfield Co. No. 9, A. B. BRUNDAGE .... Danbury
Housatonic Valley, No. 10, FRANK H. PEET .... Kent

JUVENILE DEPUTY:

MRS. SUSIE G. WILLIAMS .... Brooklyn

HOME ECONOMICS COMMITTEE:

MRS. WALLACE N. MITCHELL .... Newtown

PATRONS' MUTUAL FIRE INSURANCE COMPANY:

HENRY E. LOOMIS, President .... Glastonbury
J. ARTHUR SHERWOOD, Vice-President ..... Long Hill
W. H. CARRIER. Treasurer .... Glastonbury
H. C. DUNHAM, Secretary .... Middletown

EXECUTIVE COMMITTEE:

President, Secretary, Treasurer and
W. H. BALDWIN, Cheshire H. W. TREAT, Bridgewater

Annual Meeting in January.

PATRONS' EXCHANGE:

WALTER S. HINE, President .... Orange

OFFICERS OF THE GRANGES, 1920.

NAME	No.	MASTER	LECTURER	SECRETARY
POMONA GRANGES				
Central Pomona	1	Wm. H. Pomeroy, Meriden	Mrs. Geo. J. Reed, Berlin	Mrs. E. B. Adams, Berlin
Quinebaug Pomona	2	Franklin H. Bennette, Ashford	George H. Hamilton, R. D. 2, Putnam	Mrs. Susie G. Williams, Brooklyn
East Central Pomona	3	Donald Johnson, Wapping	Mrs. Kate Carrier, Glastonbury	Mrs. Laura J. Brewer, R. 2, Glastonbury
Mountain County Pomona	4	Burton N. Bristol, Collinsville	Mrs. Mae Daggett, Canton Center	H. P. Deming, Winsted
New Haven County Pomona	5	Emerson Leonard, Wallingford	Miss Grace E. White, Guilford	Miss Daisy G. Howell, Guilford
N. London County Pomona	6	E. Frank White, North Stonington	Rev. G. F. Goodenough, R. D., Norwich	Alice A. Bishop, R. D. 9, Norwich
Excelsior Pomona	7	Albert G. Clark, Middlebury	Mrs. Albert G. Clark, Middlebury	Mrs. A. H. Pierpont, Waterbury
Sea View Pomona	8	J. Warren Stark, Lyme	Miss Annie Smith, Chester	Myron G. Skinner, Higganum
Fairfield County Pomona	9	Dwight S. Fanton, R. D. 11, Westport	Charles C. Lacey, R. D. 1, Bridgeport	Mrs. Nellie E. Blakeman, Oronoque
Housatonic Valley Pomona	10	Wm. R. Brush, West Cornwall	Rev. B. C. Chandler, Kent	Mrs. Adele P. Brush, West Cornwall
SUBORDINATE GRANGES				
Washington	11	Charles T. Mason, Washington Depot	Willis Brown, Washington Depot	Frederic J. Ford, Washington Depot
Tunxis	13	Wm. C. Hubbard, Bloomfield	Mrs. H. J. Rowley, Bloomfield	Mrs. W. C. Hubbard, Bloomfield
Hope	20	C. Fred Newbury, R. D., Torrington	Miss K. Kimberly, R. D., Torrington	W. L. Benton, Torrington
Lebanon	21	Fred M. Abell, Lebanon	F. N. Taylor, Lebanon	Mrs. Iva Burgess, Chestnut Hill
Cheshire	23	Benj. P. Storrs, Cheshire	Mrs. Alice Terrell, Cheshire	Mrs. H. W. Durand, Cheshire
Berlin	24	Joseph L. Wilson, Kensington	Harold D. Ventres, Berlin	Mrs. E. B. Adams, Berlin
Union	25	Jas. W. Upson, Southington	Ernest Smart, R. D., Southington	Miss B. G. Parsons, R. D., Southington
Glastonbury	26	Wm. H. Carrier, Glastonbury	Louis W. Howe, South Glastonbury	George W. Andrews, Glastonbury
Suffield	27	H. D. Sikes, Suffield	Fred King, Suffield	Minnie Wilson, Suffield
Meriden	29	Harry T. G. Fuller, Wallingford	Miss Ruth G. Logan, Meriden	Mrs. Lura P. Pomeroy, Meriden
Wapping	30	Levi T. Dewey, Buckland	Mrs. Rosa Nevers, Buckland	Mrs. Gertrude Foster, Wapping
Manchester	31	John McLaughlin, South Manchester	Lucy Pinney, South Manchester	Laura G. Loomis, South Manchester
Cornwall	32	Wallace M. Hart, West Cornwall	Rev. F. Smith, West Cornwall	Miss Florence A. Benedict, Cornwall
Wallingford	33	Norman H. Barnes, Yalesville	Mrs. A. M. Williams, Wallingford	Miss F. M. Harrison, Wallingford
Cawasa	34	Winslow W. Barnes, Collinsville	Mrs. Mae A. Daggett, Canton Center	Mrs. Annette E. Case, Canton
No. Haven	35	Ralph O. Desmond, Clintonville	Miss Ethna Hoadley, New Haven	Mrs. Elsie M. Judd, North Haven
Little River	36	Raymond Baker, Hampton	Mrs. Edna Hoffman, Hampton	Mrs. Mabel Pearl, R. D. 1, Hampton
East Hartford	37	Robert A. Hall, East Hartford	Mrs. Martha Snyder, Hartford	Mrs. Amy Spencer, Hartford
New Canaan	38	J. Howard Hoyt, D. D., New Canaan	Mrs. Bertha Scofield, New Canaan	Miss Anna M. Ruth, New Canaan
Burritt	39	Albert W. Vibberts, New Britain	Miss Margaret B. Sharpe, New Britain	Mrs. F. H. Sharpe, New Britain
Senexet	40	Martin Nelson, South Woodstock	Geo. Hamilton, R. D. 2, Putnam	Louisa Clark, R. D. 2, Putnam

OFFICERS OF THE GRANGES 1920—Continued.

NAME		MASTER	LECTURER	SECRETARY
Subordinate Granges—Continued				
Konomoc	41	Guy Radway, Uncasville	Mrs. Maud Radway, Uncasville	Miss Alice L. Baker, New London
Mattabessett	42	Horace H. Peck, Middeltown	Miss Edith M. Birdsey, Middletown	C. Marsden Bacon, Middletown
Brooklyn	43	Ellsworth C. Babson, Danielson	Mrs. Cora Page, Danielson	Mrs. Addie C. Hyde, Brooklyn
Newington	44	Richard H. Erwin, Sr., R. D. New Britain	Miss Elsie M. Elliott, Newington	Mrs. Edith M. Elliott, Newington
Harwinton	45	Walter F. Balch, R. D. 2, Torrington	Mrs. Lizzie Wilson, R. D. 2, Torrington	Miss E. V. Balch, R. D. 2, Torrington
Ellington	46	Howard N. Kibbe, R. D., Ellington	John McKinstry, R. D. 4, Rockville	Fred H. Arens, Ellington
Bolton	47	Miss Adelia N. Loomis, Bolton	Miss Olive Hutchinson, Bolton	Miss Annie M. Alvord, Bolton
Whigville	48	E. A. Matthews, Bristol	Adrian Matthews, Bristol	Charles A. Matthews, Bristol
Farmington	49	Arthur J. Birdseye, Farmington	Mrs. Haidee G. Mason, Farmington	Mrs. Annie N. Ewing, Farmington
Westfield	50	E. H. Plum, R. D. 1, Middletown	Mrs. A. W. Gilbert, R. D. 1, Middletown	Mrs. E. L. Roberts, R. D. 1, Middletown
Tolland	51	Rupert B. West, R. D. 4, Rockville	Mrs. Madge R. Wilcox, Merrow	Mrs. E. W. Gunther, R. D. 2, Rockville
Vernon	52	Perry Lathrop, R. D. 1, Rockville	Allan Lathrop, R. D., Rockville	Miss Louise Schwarz, Rockville
Plainville	54	George Brooks, R. D., Plainville	Mrs. H. P. Lowrey, Plainville	Mrs. H. L. Newell, Plainville
Stafford	55	J. M. Larned, Stafford Springs	Mrs. Mattie Lasbury, Stafford	Miss Isadore Dunham, Stafford
East Haddam	56	Charles H. Smith, East Haddam	Mrs. Marie Gelston, East Haddam	Miss M. E. Countryman, East Haddam
Durham	57	A. Ernest Otte, Durham Center	Gaylord Newton, Durham	Mrs. Harold Hall, Durham Center
West Hartford	58	Bayard D. York, Hartford	Miss Daisy T. Day, Hartford	H. J. Miller, West Hartford
Wolf Den	61	A. H. Amidon, Abington	Miss Virginia S. Sharpe, Abington	Miss Francis L. Platt, Abington
Eureka	62	Bernard G. Anderson, New Hartford	Mrs. Addie Barnes, New Hartford	Mrs. Mary E. Brown, New Hartford
Middlefield	63	Francis Strickland, Rockfall	Mrs. Bertha Burnham, Middlefield	Mrs. Blanche Dudley, Rockfall
Mansfield	64	Frank P. Miller, Storrs	Arthur G. Skinner, Storrs	Mrs. Myra Crane, R. D. 2, Eagleville
Quinnatisset	65	Charles F. Whiting, Webster, Mass.	Mrs. Annie K. Barton, Thompson	Miss Lena L. Smith, Thompson
Killingworth	66	Lovel D. Parmelee, R. D. 2, Clinton	Herbert C. Stevens, R. D. 2, Clinton	Mrs. Bertha A. Heser, R. D. 2, Clinton
Cromwell	67	John H. Broderick, Cromwell	Mrs. Jessie M. Broderick, Cromwell	Mildred Pierson, Cromwell
Natchaug	68	Mrs. Myrtie C. Lanphear, Chaplin	Walter E. Lanphear, Chaplin	Frank C. Lummis, Chaplin
Shetucket	69	Russel Waldo, R. D., Willimantic	Merle Waldo, R. D., Willimantic	Mrs. Martha Moffitt, Scotland
Canterbury	70	Mrs. L. M. Frink, R. D. 1, Canterbury	Mrs. E. Wainwright, Canterbury	Levi N. Clark, R. D. 1, Canterbury
Mad River	71	Irving C. Miller, R. D., Waterbury	Mrs. B. G. Pierpont, R. D., Waterbury	Miss C. Benham, R. D. Waterbury
Plymouth	72	James Kelley, Plymouth	Edith Sutliffe, Plymouth	Ira M. Lumpkin, Plymouth
Indian River	73	H. C. C. Miles, Milford	John B. Hubbard, West Haven	Albert N. Beard, Milford
Winchester	74	Wallace E. Pendleton, R. D., Winsted	Mrs. T. Goodenough, R. D., Winsted	Fred S. Beecher, Winchester
Coventry	75	Walter S. Haven, South Coventry	Mrs. Agnes Hall, R. D. 2, Rockville	Mrs. Grace S. Reed, R. D. 2, Rockville

OFFICERS OF THE GRANGES, 1920 — Continued.

NAME		MASTER	LECTURER	SECRETARY
Subordinate Granges—Continued				
Andover	76	Frank L. Hamilton, Andover	Mrs. Cornelia T. Bass, Andover	Mrs. Marjorie Bartlett, Andover
Clinton	77	Nathan D. Meigs, R. D., Madison	Mrs. Elsada V. Carter, Clinton	Albert M. Buell, Clinton
Colchester	78	Clayton G. Miller, Colchester	Mrs. Ina Pease, Colchester	Belle L. Strong, Colchester
Housatonic	79	L. A. Stalker, Stratford	Mrs. Harold C. Holmes, Stratford	Nathan E. Welles, Stratford
Guilford	81	Charles R. Bishop, Guilford	Mrs. Harriet S. Dudley, Guilford	Miss Daisy G. Howell, Guilford
Colebrook	82	Arthur B. Ferry, R. D. 1, Winsted	Mrs. Alice Gilman, R. D. 2, Winsted	Miss Madeline G. Smith, Colebrook
Totoket	83	Nathan A. Harrison, Branford	Miss Edith Clarke, Branford	Mrs. Alice B. Miller, Branford
Foxon	84	Maurice Bailey, East Haven	Mrs. Lucretia Bailey, East Haven	Miss Elizabeth Carlson, East Haven
Webutuck	86	R. K. Woodward, Sharon	N. C. Smith, Amenia, N. Y.	Mrs. F. R. Rundall, Amenia, N. Y.
Hillstown	87	Chas. G. Strickland, R. D., Glastonbury	Neva Cummings, R. D., Glastonbury	Harry J. Brewer, R. D., Glastonbury
Ekonk	89	Thomas A. Brown, R. D., Moosup	Miss Gladys G. Gallup, R. D., Moosup	Mrs. Phebe E. Gallup, R. D., Moosup
Ashford	90	Alex. M. Bassett, Warrenville	Mrs. Ruth E. Towle, Warrenville	Mrs. Addie S. Bassett, Warrenville
Seymour	91	Pasquale Ajello, R. D. 2, Seymour	Mary Hull, R. D. 2, Seymour	Emma E. Francis, R. D. 2, Seymour
Harmony	92	Mrs. M. L. Lacey, R. D. 1, Bridgeport	Miss Lillian I. Lewis, Stepney Depot	C. B. Burr, R. D., Stepney Depot
East Windsor	94	Alfred F. Potwine, Warehouse Point	Mrs. Allena Allen, Warehouse Point	Miss Alice Barber, Warehouse Point
Pachaug	96	Merton Bartlett, R. D. 1, Jewett City	Mrs. G. Bartlett, R. D. 1, Jewett City	Miss Ola Tanner, Voluntown
Putnam	97	Mrs. Dorothy Bartlett, Putnam	Miss Alice Devine, Putnam	Mrs. Elsie Johnson, Putnam
Taghhannuck	100	Mrs. Alida C. Buckley, Amenia, N. Y.	Mrs. Adella Thorp, Sharon	Miss Marjorie Hand, Sharon
Mashapaug Lake	101	L. M. Reed, Stafford Springs	Ella C. Barrows, Stafford Springs	Nelson E. Horton, Stafford Springs
Beacon Valley	103	Elmer Tucker, Naugatuck	Mrs. Idella Tucker, Naugatuck	Mrs. Delia B. Sanford, Naugatuck
Somers	105	Albert S. Hurlbut, Somers	Jeanie Gager, Somers	Elmira M. Galbraith, Somers
Litchfield	107	James D. Coffill, Litchfield	Walter A. Cook, Litchfield	Frederick A. Stoddard, Litchfield
Woodbridge	108	Edward A. Hitchcock, Westville	Mrs. Elinore Cabot, Westville	Leroy C. Beecher, Westville
East Hampton	109	Barney Walstadt, East Hampton	Mrs. Grace Goff, East Hampton	Mrs. Ola M. West, East Hampton
Preston City	110	Clifton L. Dawley, R. D. 1, Norwich	Chas. C. Zabriskie, R. D. 1, Norwich	Webster D. Copp, Norwich
Hebron	111	C. W. Hutchinson, R. D. 2, Andover	Mrs. Clara Hanmar, R. D. 2, Andover	Mrs. Mary G. Buell, R. D. 2, Andover
Killingly	112	Walter F. Day, R. D., Killingly	Frank L. Bennett, R. D., Killingly	Miss Annie L. Page, Danielson
Highland	113	Louis S. Barstow, R. D., Killingly	Mrs. I. M. Tillinghast, R. D., Danielson	Jacob L. Spaulding, R. D., Danielson
Wethersfield	114	Walter M. Coe, Wethersfield	Mrs. Alice E. Lowe, Wethersfield	Miss Jennie L. Stevenson, Wethersfield
Rocky Hill	115	William J. Kermode, Rocky Hill	Mrs. Charlotte E. Elliott, Rocky Hill	Mrs. Lillian M. Backe, Rocky Hill
Bristol	116	Harry M. Perkins, Bristol	Mrs. Ethel Sperry, Bristol	Miss Helen Burgess, Bristol
Unity	117	Shirley B. Dickinson, Deep River	Mrs. Helen L. Stevens, Deep River	William Lonnberg, Deep River
Beacon	118	Robt. A. Goodwin, R. D. 2, Litchfield	Rev. Wallace Humiston, Northfield	Charles S. Hulme, R. D. 1, Thomaston
Morris	119	Vernon A. Raymond, Bethlehem	Elizabeth D. Twing, Thomaston	A. Ernest Anderson, East Morris

OFFICERS OF THE GRANGES, 1920 — Continued.

NAME		MASTER	LECTURER	SECRETARY
Subordinate Granges—Continued				
Bethlehem	121	Walter P. Lake, Bethlehem	Miss Clista Scrumm, Bethlehem	Miss Sarah Howard, Bethlehem
Watertown	122	Henry S. Atwood, Watertown	Mrs. Helen B. Beach, Watertown	John Abbott, Watertown
Higganum	124	August B. Carlson, Higganum	Mrs. Paul Priest, Higganum	Everett E. Kahrman, Higganum
Hollenbeck	125	Mrs. Dorville Merriman, Falls Village	Mrs. H. N. Wright, Falls Village	Miss Mabel Dean, Falls Village
Good Will	127	Robert P. Watrous, Glastonbury	Mrs. E. T. Watrous, Glastonbury	Arthur M. Marsh, Glastonbury
Pohtatuck	129	Rev. W. C. Cravner, Newtown	Mrs. W. N. Mitchell, Newtown	Miss Charlotte C. Minor, Newtown
Farmill River	130	George Arundell, R. D. 8, Shelton	J. Edward Palmer, R. D. 8, Shelton	Mrs. George Arundell, R. D. 8, Shelton
Columbia	131	Luther Buell, Columbia	Mrs. Ethel Blakeley, Columbia	Raymond E. Clarke, Columbia
Wichita	132	Herbert R. Tanner, New Preston	Mrs. Joy Perkins, Cornwall Bridge	Miss Lois Perkins, Cornwall Bridge
Greenfield Hill	133	W. Burr Hill, Fairfield	Mrs. Clifford S. Banks, Fairfield	Nellie B. Wilson, Fairfield
Trumbull	134	Howard F. Randall, R. D. 3, Bridgeport	Mrs. Welles Dewey, Long Hill	Mrs. Wm. Fuller, R. D. 5, Long Hill
Silver Lake	135	E. Franklin Byron, Sharon	Mrs. F. L. Bristol, Sharon	Miss Evelyn D. Scott, Sharon
East Canaan	136	E. S. Root, Canaan	J. C. Stevens, R. D., Canaan	Clara M. Bottum, East Canaan
Willington	137	Mrs. J. E. Nichols, West Willington	Mrs. G. V. Smith, West Willington	
No. Stonington	138	Clifford B. Thompson, No. Stonington	Mrs. Nellie Coats, North Stonington	E. Frank White, North Stonington
Middlebury	139	A. F. Greene, Middlebury	Mrs. A. F. Greene, Middlebury	Florence C. Clark, Middlebury
Plainfield	140	William S. Exley, Plainfield	George H. Dawley, Plainfield	Mrs. Evelyn A. Hall, Plainfield
Rock Rimmon	142	Mrs. Mary R. Clark, Beacon Falls	Miss Ethel M. Clark, Beacon Falls	Miss Ruth M. Carroll, Beacon Falls
Goshen	143	Charles Peck, Goshen	Mrs. Mary T. Allyn, Goshen	Miss Louise E. Wright, Goshen
Prospect	144	Albert S. Talmadge, R. D. 2, Waterbury	Mrs. A. S. Talmadge, R. D. 2, Waterbury	Mrs. C. P. Wallace, R. D. 2, Waterbury
Rippowam	145	Guy S. Clark, R. D., Greenwich	Mrs. Anna Mead, R. D. 29, Stamford	Miss D. L. Horner, R. D. 29, Stamford
Norfield	146	Frank C. Fitch, Westport	Myra Waterbury, Westport	May Fitch, Westport
Lyme	147	Arthur Sweet, Lyme	Mrs. Lydia Irvine, Lyme	Mrs. Florence Hall, Lyme
Easton	149	Clarence B. Andrews, Long Hill	Willard S. Gillette, Long Hill	Mrs. Minnie Edwards, Long Hill
Enfield	151	Ernest Corbin, Hazardville	John F. Luddy, Hazardville	Harry J. Bridge, Hazardville
Cannon	152	James O'Donnell, Cannondale	Rev. J. H. Fairchild, Cannondale	Mrs. L. R. Ambler, Cannondale
Bridgewater	153	Edward B. Wooster, Bridgewater	Miss Frederica E. Starr, Bridgewater	Miss Mary J. Hatch, New Milford
Kent	154	William E. Templeton, Kent	Mrs. Annie Peet, Kent	Miss May Chamberlin, Kent
Danbury	156	Mrs. C. Barnum, R. D. 6, Danbury	Chas. H. Brundage, R. D. 1, Danbury	Frank H. Bailey, R. D. 5, Danbury
Chester	158	Frank D. Sypher, R. D., Deep River	Harry J. Zack, Chester	Miss Marguerite Goken, Chester
Salisbury	159	G. A. Selleck, Salisbury	Mrs. Susie E. Bell, Salisbury	Mrs. Mary C. Petersen, Salisbury
Aspetuck Valley	160	Charles Stafstrom, New Milford	Ivah Murray, New Milford	Arthur Murray, New Milford
Bozrah	161	Charles B. Davis, R. D. 2, Yantic	Mrs. Emma Davis, R. D. 2, Yantic	Mrs. E. M. Lathrop, R. D. 9, Yantic

OFFICERS OF THE GRANGES, 1920 — Continued.

NAME		MASTER	LECTURER	SECRETARY
Subordinate Granges—Concluded				
Old Lyme	162	W. F. Clark, Old Lyme	Mrs. Minnie Sterling, Old Lyme	Mrs. J. Maude Ashley, Old Lyme
Redding	163	Mrs. Oliva Sanford, Redding	Gustave Bergquest, R. D. 24, Bethel	Mrs. Bessie Sanford, R. D. 24, Bethel
Bethel	164	John P. Wixted, Bethel	Mrs. Dovede Stryker, Bethel	Mrs. Actie D. Judd, Bethel
Ridgefield	165	Caro H. Northrop, Ridgefield	Arthur W. Northrop, Ridgefield	Arthur H. Thomas, Ridgefield
Ledyard	167	Joseph A. Clark, R. D. 6, Norwich	Mrs. U. A. Avery, R. D. 6, Norwich	Samuel E. Holdridge, R. D. 6, Norwich
Stonington	168	Ralph C. Wheeler, Stonington	Raymond A. Spargo, Westerly, R. I.	Miss Natalie S. Hazard, Westerly, R. I.
Riverton	169	Geo. M. Ransom, Riverton	A. L. Lewis, Riverton	Mrs. Jessie E. Coe, Riverton
Wemanesa	170	W. B. Hungerford, Gaylordsville	Mrs. Emmeline Haring, South Kent	Mrs. J. M. Hungerford, Gaylordsville
Mystic	171	L. O. Allen, Mystic	Miss Sara Gookin, Mystic	Clarence Coogan, Mystic
Norwich	172	John R. Lyman, East Great Plain	Mrs. J. O. Peckham, Norwich	Mrs. Lila J. Saunders, Norwich
Wolcott	173	Charles Nelson Coe, R. D. 2, Bristol	Miss E. Warner, R. D. 1, Waterbury	Mrs. E. A. Norton, R. D. 4, Waterbury
Torringford	174	A. C. Janssen, R. D. 3, Torrington	G. H. Johnson, R. D. 3, Torrington	Mrs. E. B. Hopkins, R. D. 3, Torrington
Lake Valley	175	John G. Morren, R. D. 1, Gaylordsville	Miss E. K. Beyer, R. D. 1, Gaylordsville	Miss W. Mosher, R. D. 1, Gaylordsville
Groton	176	Laura Perkins, Groton	Mrs. Jennie Needham, Groton	Miss Amanda Allen, Groton
Haddam Neck	177	L. J. Selden, R. D., East Hampton	Mrs. C. G. Crocker, R. D., East Hampton	Mrs. E. G. Clark, R. D., East Hampton
Avon	179	Reuben Miller, Avon	Mrs. C. B. Hadsell, Avon	Dorothy Manion, Avon
Echo	180	Elmer Lanphear, Mansfield Center	Mrs. Gladys I. Alford, Willimantic	Miss A. O. Storrs, R. D. 1, Eagleville
Hemlock	182	Harry L. Pratt, Portland	Mrs. Hazel Hale, Portland	William B. Synnott, Portland
Franklin	184	Milton F. Beckwith, R. D. 2, Yantic	Mrs. Nettie T. Race, No. Franklin	Miss Catherine C. Holton, No. Franklin
Pomperaug	185	Samuel E. Cook, Southbury	Mrs. Florence Hicock, Southbury	Mrs. Mary E. Mallory, Southbury
Shelton	186	Wm. Appleby, Shelton	Miss Marie Gressott, Shelton	Mrs. Emma C. Wakelee, Shelton
Hartland	187	E. A. Gaylord, West Hartland	Mrs. Mae Le Geyt, Barkhamsted	Mrs. Hattie E. Gaylord, West Hartland
Bethany	188	Wallace S. Saxton, R. D. 3, Bethany	Mrs. M. Woodward, R. D. 2, Bethany	Arthur H. Kinney, New Haven
Victory	189	William Bettes, Riverton	Mrs. Mary Bourquin, Riverton	Miss Helen L. Seymour, Riverton
Metichewan	190	Harris Hamlin, Brookfield	Nicholas Glennon, New Milford	Miss Ethel Osborne, Brookfield

CONNECTICUT'S DISPLAY AT THE EASTERN STATES EXPOSITION.

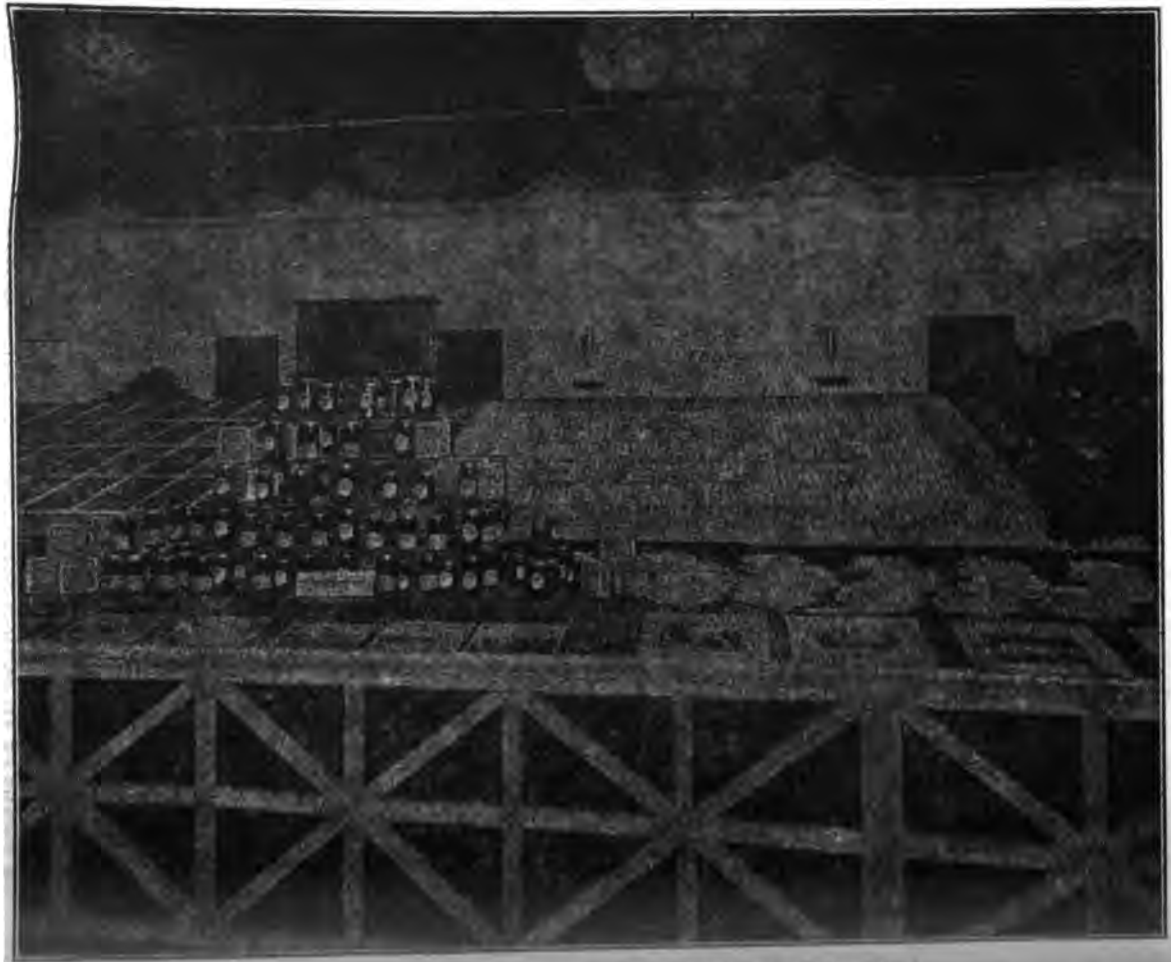
For three years previous to 1920 Connecticut has made an exhibit at the Eastern States Exposition, but never before has as much pains been taken and as much labor been put into the effort to have an atractive display as during the present season. Both from the viewpoint of attractiveness and effectiveness the Connecticut exhibit in the "Avenue of States" in Machinery Hall was acknowledged to be an outstanding feature of this year's Exposition. The Connecticut boys and girls at Camp Vail in the Junior Achievement section and the general exhibits in Horticultural Hall by Connecticut exhibitors were given an unusually high rating by the visiting public. This combination of efforts contributed in making the state's record one of the highest at the Exposition.

As the visitors entered Machinery Hall they found the Connecticut exhibit, under the charge of the State Department of Agriculture, in the northeast corner, being the first of the exhibits of the various New England States to meet the eyes of those entering the building.

In its complete form the exhibit was unusually striking, and its arrangement was such that it led the other states in appearance, the plan of arrangement showing a keen regard for effectiveness, and all being combined to make a lasting impression upon those who saw it.

This exhibit was systematically divided into divisions so that any one interested in a special line of agricultural work could see at a glance that in which they were patricularly interested.

That part of the exhibit representing the dairy interests occupied the first section of the exhibit. A model farm with all of the farm activities was devised. It was demonstrated by means of an endless chain railway. All combined to give a graphic idea of the activities on a dairy farm and what those activities accomplish. This exhibit consisted of a back



Connecticut Exhibit at Eastern States Exposition, [illegible] ground of farm greenery, miniature farm buildings, grain fields, pastures, animals and dairy vehicles. It showed the grain of various sorts being harvested, the loading on to farm wagons and the transporting to the barns where it was stored for the use of the animals therein. By means of another endless chain the result of these farm products when consumed by the animals and converted into dairy products was shown in the form of butter, cheese, cream, milk and other products, all of them en route from the farm to the homes of the consumer. It was as effective a demonstration of the mission of the model dairy farm as could be devised.

The next section was given over to exhibits from the fruit orchards of Connecticut, the general display being composed of apples, pears and peaches, while several other kinds were in evidence. This display of fruit so complete in itself attracted the special attention of those in attendance, many of whom vouchsafed the information that there was none better on exhibit, and that Connecticut was entitled to the card which it displayed saying that "Connecticut Fruit Excels."

Perhaps the most striking feature of the entire exhibit was the display of eggs in the third section. This was surely unique, everyone testifying to the fact that they had never before seen eggs displayed in such a manner. It consisted of a rectangle 10½x7 feet, the foundation of which was white eggs with a border of brown ones. In the center the words "Connecticut Eggs" were displayed, brown eggs being used for this purpose. Four thousand, three hundred and twenty eggs were used in this exhibit. As a background there were alcoves in which large silver cups were shown which had been won by Connecticut eggs at other exhibits.

The fourth section of the general exhibit was given over to the showing of vegetables grown in Connecticut. This was arranged in an attractive form, and while it did not draw the attention of the visitors as much as some other parts of the exhibit did, it was considered as good as any vegetable exhibit in the Exposition. The display of vegetables was comprised of almost every known variety raised in Connecticut. These were exhibited in group form, while in front there were trays of vegetables containing small samples of the many varieties grown.

One of the interesting features of the entire exhibit was the display of photographs along the aisle, each section being illustrated by farm photographs applicable to that section. The ones in the foreground of the vegetable exhibit showed modern methods used in the cultivation of the vegetables shown. A large portion of Connecticut agriculture is given over to market gardening, and while this exhibit was secured mostly from growers in Hartford and Windham Counties, it was a good illustration of what can be done in many sections of the state.

The sheep and swine breeders of the state also made exhibits, demonstrating the success attained by those interested in the above mentioned industries in the state.

The apiaries in Connecticut were represented by a splendid exhibit of honey products. There were also quantities of honey for sale at the sales booth, which handled Connecticut apples and Connecticut ice cream as well.

The exhibit taken as a whole received only enconiums of praise from those in attendance. This together with the records of those who were members of the state boys' and girls' clubs at Camp Vail in the Junior Achievement exhibit, and the success of the horticulturists in competing for premiums in the Horticultural Department, has placed Connecticut in the foremost ranks as one of the leading state exhibitors of New England.

The majority of the first prizes for apples in Horticultural Hall went to Connecticut growers. The Pine Knob Orchard at Rockville won a blue ribbon for fruit farm exhibits.

The Mountain View Orchards at Hazardville won first on advertising display. The Connecticut Pomological Society won first for a state exhibit. The blue ribbon for an unlimited vegetable collection also went to Connecticut, being carried off by the Hartford Market Gardeners' Association.

There were sixty young people representing the state in the Junior Achievement Village at Camp Vail, as demonstration teams and judging teams in all branches of the work offered. New Haven and Waterbury industries were interestingly shown by Junior Achievement boys and girls at the industrial village. A team of three girls demonstrated the making of rubber into many useful appliances for the home. This New Haven Rubber Team started with crude rubber taken from the rubber trees in the West Indies. The girls traced the process of harvesting, transporting and refining and then showed the use which was made of the finished product, even to the making of a complete pair of overshoes. Three boys from the Davenport Settlement House at New Haven demonstrated electrical appliances. There were also teams demonstrating the hardware, toy, basketry, furniture and the banking industries of New Haven. Waterbury too had a demonstrating team making exhibits in brass work. The display made by "My Own Room Club" which was put on by the girls from Waterbury was an interesting exhibit. Canned fruit and vegetables were shown by other clubs. The display made by the Goshen Poultry Club attracted its share of attention.

Prizes almost without number were won by Connecticut exhibitors. Not only in the boys' and girls' department, but Connecticut competitors in the Ayrshire, Guernsey, Holstein, Jersey and Poled Angus classes received their share of awards. While Connecticut is known as an industrial state it surely holds its own in an agricultural exhibit.

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State of Connecticut

PUBLIC DOCUMENT No. 29

BIENNIAL REPORT OF THE TRUSTEES

OF THE

CONNECTICUT AGRICULTURAL COLLEGE

AT

STORRS, CONNECTICUT

For the two fiscal years ended June 30, 1920, and for the two years in other matters ended November 30, 1920

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LETTER OF TRANSMITTAL.

To His Excellency, Marcus H. Holcomb, Governor of the State of Connecticut:

I have the honor to submit herewith the report of the Board of Trustees of the Connecticut Agricultural College for the two fiscal years ended June 30, 1920, and for the two years in other matters ended November 30, 1920.

Very respectfully,

OLCOTT F. KING,

Secretary of the Board of Trustees.

THE CONNECTICUT AGRICULTURAL COLLEGE.

BOARD OF TRUSTEES

The Governor of Connecticut..........Ex-officio

MARCUS H. HOLCOMB, Southington

Appointed by the Governor

	Term Expires
E. STEVENS HENRY, Rockville	1922
WILLIAM H. HALL, South Willington	1923
ROBERT SCOVILLE, Taconic	1923
CLIFFORD I. STODDARD, Woodbridge	1921
JOSEPH W. ALSOP, Avon	1921
E. KENT HUBBARD, Middletown	1921

Elected by the Alumni

OLCOTT F. KING, South Windsor	1923
HARRY G. MANCHESTER, Winsted	1921

Elected Annually by the Board of Agriculture

EVERETT E. BROWN, Pomfret Center	1921

Officers of the Board

GOVERNOR MARCUS H. HOLCOMB	President
HARRY G. MANCHESTER	Vice-President
OLCOTT F. KING	Secretary
CLIFFORD I. STODDARD	Treasurer

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Experiment Station Committee

E. STEVENS HENRY, ROBERT SCOVILLE

Extension Committee

O. F. KING, E. KENT HUBBARD, E. E. BROWN

Administration Committee

H. G. MANCHESTER, O. F. KING, E. K. HUBBARD

Auditor

O. F. KING

Part I.

REPORT OF THE PRESIDENT.

To the Trustees of the Connecticut Agricultural College:

I have the honor to submit herewith a report for the two years ended November 1, 1920.

Appropriations for Buildings:—The legislature of 1919 made an appropriation of $162,095 for buildings and improvements;—Dining Hall $66,600; Infirmary $8,320; Faculty Cottages $62,700; Drainage of land $6,400; Temporary Chemical Laboratory $10,000; Equipment for Chemical Laboratory $5,000 and Poultry Building $3,075.

Dining Hall:—When bids were received it was found that the appropriation for the erection of the Dining Hall and the Infirmary was inadequate. The State Board of Control on petition of the Trustees authorized the transfer of the appropriation for the Chemical Laboratory to the Dining Hall account and granted also an additional allowance of $37,966, making a total of $122,886 for the construction of these two buildings.

Faculty Cottages:—Fire destroyed Grove Cottage July 8, 1919. The Board of Control authorized the use of the insurance money from Grove Cottage for the erection of dwelling houses. The insurance fund amounting to $17,492.16 together with the appropriation of the legislature, $62,700, was used in the construction of four double and two single cottages.

Dairy Barn:—The Dairy Barn was destroyed by fire July 6, 1919. The Board of Control authorized the Trustees to use the money received from insurance, $22,836.27, to replace this building. This amount was inadequate for the erection of a suitable barn and the Trustees voted to use twenty thousand dollars from the proceeds of the sale of the Dunham Farm for this purpose.

Water Supply:—The legislature of 1919 made an appropriation of $130,000 for a water supply for the Mansfield Training School and the Connecticut Agricultural College. A farm of 130 acres controlling the water shed has been purchased from Dennis Costello, the pipe line has been laid and the pumping station is in process of erection. This plant when completed will provide an adequate water supply for both institutions.

Woman's Building:—The Special Session of the General Assembly September 21, 1920, made an appropriation of $335,000 for the erection and equipment of a Woman's Building to be used as a dormitory and for instruction in Home Economics. Plans have been prepared by D. K. Perry, Architect, and it is expected that the building will be ready for occupancy in the fall of 1921.

Promotion of Sheep Husbandry:—Chapter 130 of the Public Acts of 1919 provides that: "The Trustees of the Connecticut Agricultural College shall supervise and establish such distribution and demonstration flocks of sheep throughout the state as they shall deem necessary, and conduct such experiments and investigations as may seem to them most conducive to the encouragement of the sheep industry throughout the state." A farm of about 200 acres has been purchased at Spring Hill. Several carloads of sheep have been distributed to farmers of the state. Two thousand dollars of the annual appropriation is used for investigation, three thousand dollars in paying the salary and expenses of an extension specialist and five thousand in maintaining the farm and demonstration flock.

Retirement System for Teachers in State Institutions:—Chapter 83 of the Public Acts of 1919 provides that: "The Teachers' Retirement Board may, upon application by the board of trustees of any institution supported by the state at which teachers are employed, class such institutions as a public school under the provision of section 1015 of the general statutes." On application of the Trustees, the college has been admitted to the Retirement System for Teachers. The retirement system provides for the payments of annuities and pensions of teachers upon retirement. Membership is compulsory for all teachers who begin service for the first time after June 30, 1919. The association collects an assessment of 5% of the teacher's annual salary. A teacher is eligible for retirement upon reaching the age of 60, or under 60 years of age if he has had at least 35 years of service in the public schools of Connecticut.

State Highway for the College:—Chapter 150 of the Public Acts of 1919 provides that: "The highway from North Coventry to Mansfield Depot and thence to the Connecticut Agricultural College in the town of Mansfield is included as a part of the trunk line system of highways." This road, when built, will provide a direct line from the college to Hartford some 12 miles shorter than the present route by way of Willimantic. This road will enable the institution also to effect a considerable saving in the cost of hauling coal, building material and miscellaneous freight. The freight station for the college is to be changed from Eagleville to Mansfield Depot.

Application of Workman's Compensation for Employees of the College:—The Workman's Compensation Act passed in 1913 provides for a system of compensation for personal injuries sustained by employees arising out of and in the course of their employment. The benefits of this act apply to all employees but the method of determining the amount of compensation due in case of personal injury while in the employ of the state and the method of collecting claims was not defined in the compensation act. Four workmen injured while in the employ of the college presented to the Trustees claims for compensation for medical attendance and for loss of wages. The Trustees petitioned the legislature of 1919 for reimbursement of these expenditures. The petition was referred to the committee on claims. As a result of the hearings and on the advice of the Attorney General, the Trustees were advised to report all accidents involving employees of the college to the Compensation Commissioner. The Compensation Commissioner then forwards his findings in each case to the State Comptroller, who draws an order payable to the injured employee for the amount of the compensation.

Scholarship Loans:—The funds provided by the State for County Scholarships is proving of great benefit to students in need of financial assistance. Applications from students are passed upon by a committee of the faculty. The scholarships take the form of loans, which are limited in amount to a maximum of $100 to an individual student in a college year. The loans may be considered as deferred settlement of the semester fees and are secured by notes payable in a reasonable period after graduation. A total of 133 loans have been granted, of which 10 have been paid, 89 are held by students now in college, and 34 are now due.

Board of Trustees:—The Governor in 1919 appointed E. Stevens Henry, William H. Hall and Robert Scoville as Trustees for a period of four years; the Board of Agriculture in 1919 and again in 1920 elected Everett E. Brown for a period of one year; the Alumni in June, 1919, elected Olcott F. King for a period of four years. Charles M. Jarvis, who had served the College as Trustee with great ability for a period of 10 years, resigned in December, 1919. Clifford I. Stoddard was appointed to fill the unexpired term.

Enrollment of Students:—The average enrollment for the five-year period, 1915-1919, was 212 students. The enrollment for 1920 was 354, or an increase of 67%. The enrollment for the current year will equal the number registered in 1920. The attendance in the School of Agriculture was 51 and in the college 303, of whom 192 elected Agriculture, 57 Home Economics, 28 General Science and 26 Mechanical Engineering.

The number of young women enrolled in the college was 11 in 1916-1917; 25 for the year 1917-1918; 41 for the year 1918-1919 and 65 for the year 1919-1920.

School of Agriculture:—The School of Agriculture was designed to train young men for farming and for positions as farm superintendents. The school failed of its purpose in a measure inasmuch as a considerable number who entered were immature in age and unfamiliar with farm conditions. Beginning in the fall of 1920, one year of practical farm experience was required for admission and the age for matriculation was advanced from 16 to 18 years. To correspond with the seasonal work of the farm, the school year was shortened from 36 to 20 weeks, the fall term opening about the middle of October and the spring term closing about the first of April.

NEEDS OF THE INSTITUTION FOR MAINTENANCE.

1. **Maintenance of the Storrs Experiment Station:**—The State appropriates $12,500, and the Federal Government appropriates $15,000 annually to the Experiment Station. The Federal Grant was intended to form a nucleus of a fund to be supplemented by equal, if not larger, appropriations from the State. All agencies for the promotion of agriculture, including the College, Extension Service, Institute Boards and Agricultural Associations are dependent upon Experiment Stations for the information which they disseminate. Connecticut should do her share and it is not to the credit of the State that she draws so large an amount from outside sources. To insure the future development of agriculture on a sound basis it is important that the appropriation to the Storrs Experiment Station for investigation should be increased in proportion to the funds made available for resident and extension teaching.

2. **Extension Service:**—As the term implies, agricultural extension is an activity that aims to extend to the farmer the results of scientific research and experiment. The farmer cannot come to the College, but information can be taken to him. The Federal Government and the several states have expended large sums of money in developing scientific knowledge relating to agriculture. The Extension Service is an agency which aims to afford instruction and demonstration in Agriculture and in Home Economics to persons not attending the Agricultural College, by lectures and demonstrations and otherwise in the various communities in the State. An Extension Service has been organized at the College with a director and a staff of assistant specialists in the lines of Dairying, Poultry Husbandry, Home Economics, Marketing, Farm Management, Agronomy, and Boys' and Girls' Club Work. An organization has been formed and a leader appointed in each county of the State. The activities of the Extension Service have been gradually extended by reason of the War. The famine conditions in Europe which must be alleviated by large shipments of food from the United States call for a continued stimulation of crop production and food conservation. The Extension Service should receive liberal support from the legislature in order that its activities need not be curtailed.

3. **College Division:**—There should be an increase in the State appropriation for the maintenance of the College Division to meet:

(a) Additional cost of labor, fuel and supplies; (b) to meet added cost of instruction due to an increased student enrollment; (c) to permit an increase in the salaries paid to instructors; (d) to permit a higher quality of instruction and a wider range of elective courses:

(a) The cost of coal, labor, supplies and insurance has increased 100%.

(b) The student enrollment in 1919 and 1920 has increased 67% over the average of five years preceding. The larger student body necessitates an increase in the salary budget.

(c) The turn-over in the teaching staff has been 45% in the past two years and 47% in the Extension Service. It is not to be expected that every new instructor will remain permanently with the institution. The Trustees should be in a position, however, to retain a teacher of proven worth who resigns to accept a similar position at another institution at a higher salary. The present salaries of 18 professors averaging $3,178 and the salaries of 17 instructors averaging $2,126 should be increased $500 each.

(d) There are 65 young women registered in the course in Home Economics. This course is designed for those who are preparing to be teachers. Under a ruling of the Federal Vocational Board, funds from that source cannot be used for the payment of salaries of teachers of mixed classes. As result, all women students are required to take the prescribed course. It is urged that young women should have the opportunity for a wider election and that courses in Home Making, Nutrition and General Science, should be provided for those who do not intend to follow teaching as a profession. The importance of teaching of higher quality needs consideration. There is a demand for special courses in forestry, landscape gardening and bee-keeping and a general course for those who expect to engage in Extension work.

Summary of the needs of the Institution for Maintenance for the two-years period 1921-23.

1.	Experiment Station	$ 50,000
2.	Extension Service	220,000
3.	College Division	369,145
		$639,145

NEEDS OF THE COLLEGE FOR BUILDINGS AND IMPROVEMENTS.

1. **Science Hall:**—The Chemical Laboratory was destroyed by fire in November, 1917. The room in the Administration Building, formerly used as a chapel, has been remodeled to provide accommodations for laboratories in Chemistry. Arrangements have been made for the analysis of samples in connection with the research work of the Storrs Experiment Station at the Laboratory of the Connecticut Agricultural Experiment Station at New Haven. The Chemical laboratories are over-crowded and several courses have been omitted on account of the lack of proper facilities. The department of Botany is quartered at present on the second floor of the Horticultural Building, the department of Physics in the attic of the Horticultural Building, the department of Bacteriology on the third floor of the Dairy Building and the department

of Zoology in the Main Building. The laboratories in each case are inadequate in size, and the room thus occupied is needed for other purposes. It cannot be too strongly urged that a group of subjects fundamental to agriculture and occupying from one-fourth to one-third of the total time of the students during a four-year course of study, should receive recognition and that adequate laboratories should be provided both for study and research.

2. **Faculty Cottages:**—The addition of new members to teaching and Extension staffs and marriage of the younger members of the faculty, makes it necessary to provide for additional cottages. No provision having been made by the state for the lease of building sites on the campus, it is necessary for the Trustees to erect a sufficient number of buildings for the members of the teaching, extension and experiment station staffs. The College owns thirty-one cottages and two apartment houses, which are rented and yield a fair return on the investment. There is need at present for four double and four single faculty cottages. Additional cottages are needed for the accommodation of the employees of the institution.

3. **Dairy Husbandry:**—Barn for Young Cattle:—The herd, composed of representatives of the dairy breeds of cattle, is kept for instruction and experimental purposes. The product of the herd is sold in the form of milk, cream and butter to the boarding club and faculty families. The amount of milk produced, however, is not sufficient to supply the demand, making it necessary to purchase a considerable amount of dairy products during each month of the college year. The Dairy barn should be enlarged, therefore, and the size of the herd increased to at least double the number of milking animals.

(3b). **Refrigerator Equipment for Creamery:**—The refrigerator equipment at the Creamery has been in continuous use for about twenty years. The compressor condenser and brine distribution system are beyond repair and will need to be replaced. The cost of new equipment is estimated at $6,000.

4. **Forging Shop and Equipment:**—A course in forging is offered to the students of the School of Agriculture and to the students in the College of Mechanic Arts. At the present time the equipment of ten forges with anvils and necessary tools is installed in a leased shop near the campus. The equipment is meager, and the accommodations are insufficient for the number of students registering for this work. It is recommended that a building 62x34 feet, 12 feet high, conforming in style of architecture with the Mechanic Arts Building, be erected near the present building. The cost of such a structure is estimated at $7,000. and equipment at $3,000.

5. **Carpenter Shop and Storage House for Building Supplies:**—The superintendent of buildings is expected to carry in stock a supply of lumber, hardware and cement and plumbing, painting and electrical supplies used in repairs to buildings, and the maintenance of the plant.

A building is needed to house repair and building supplies and to provide accommodations for carpenter, plumbing and paint shops.

6. **Dormitories:**—Two dormitories have been built, designed to house 66 students each. The over-crowding of living quarters as at present is not conducive to good deportment or serious scholarship. A dormitory to house 100 men is needed to accommodate the male students now enrolled. (When this building is erected, it will not be wise to attract or receive additional students until needed buildings and equipment are provided for the adequate instruction of students nor until sufficient funds are provided for the adequate maintenance of the institution at its present size.

7. **Horticultural Department. Fruit Storage and Tool House:**—Refrigerator rooms and storage space for fruit and vegetables are needed as an addition to the equipment of the Horticultural Department. With the crops now harvested there is much waste and loss of both fruit and vegetables due to improper facilities of handling and packing. In connection with this department there should be erected a barn for the housing of tools and equipment used by the Pomological, Vegetable Garden, Forestry and Landscape Departments.

(7b). Improvement of Land:—As a result of the growth of the college, land formerly used by the Horticultural and Vegetable Gardening Departments has been pre-empted for building purposes and extension of the athletic field. Funds are needed for the improvement of land to be used for the cultivation of vegetables and small fruits.

8. **Farm and Animal Husbandry Department:**—The farm connected with an agricultural college is essentially an out-door laboratory. Various types and breeds of livestock are used for practice in judging and the latest improved machinery for classroom instruction and field demonstration. The farm is in need of a building for the storage of tools and the housing of farm machinery. Several tenement houses are needed for the occupancy of employees of the farm.

Stock judging is a required subject in the freshman year and advanced courses are elective in the sophomore, junior and senior years. Two hundred and seventy-nine students were enrolled in stock judging last year. In the early fall and late spring it is possible to conduct classes in stock judging out of doors. In cold and inclement weather, however, out-door classes are conducted at a disadvantage and loss of efficiency. A stock judging pavilion is needed for use of classes during the college year and to accommodate larger audiences during Farmers' Week and other summer meetings. Other breeds of sheep, swine, beef cattle and horses should be added when funds are available.

9. **Coal Bunker and Freight House:**—The College uses about 3,000 tons of coal annually, which is carted at present from Eagleville. On the completion of the trunk line highway from North Coventry to the College, the freight station will be changed from Eagleville to Mansfield Depot. The passing of coal to wagons or trucks from hopper-bottomed

cars of the gondola type with high sides is accomplished by slow and laborious effort. Land should be acquired for a freight siding at Mansfield Depot, and funds provided for the construction of a track and equipment including a trestle for the economical handling of coal, and bunkers for the storage of fuel at the railroad siding and at the power plant. There is needed also a freight house with capacity of several carloads for the storage of grain, feed and miscellaneous supplies.

10. **Ornamental Planting:**—Charles N. Lowrie was engaged in 1910 to prepare a plan for laying out the campus with respect to its future growth, taking into account the location and grouping of buildings, laying out of walks and drives, and ornamental planting. By means of a well studied plan, convenience and economy of circulation should be secured. Furthermore, the effect upon students and others of fine surroundings and landscape scenery is of great importance and should have far-reaching results where so much of the time is spent in the open air as is true at an agricultural college. Funds should be available each year for the construction of walks and drives and for the ornamental planting of the campus.

11. **Fire Protection:**—The value of college buildings and contents is over $2,000,000. The average rate for insurance is about .42 for all buildings and contents, which is as low as could be expected under present conditions. The cost to the college for insurance is about $5,800 a year. With adequate facilities for fire protection, there should be a material reduction in the cost of insurance and greater safety for both lives and property.

12. **Seed House and Barn for Experiment Station:**—In the conduct of crop experiments and the development of pure strains of plants true to type, it is essential that seed be carried over from season to season through a period of years. The Department of Agronomy is in need of a building where seeds and crops when harvested can be kept dry and secure and for the housing of tools and equipment.

13. **Apiary:**—The College has purchased forty colonies of Italian bees. Linton B. Crandall, a specialist in bee culture, has been engaged to give instruction to students at the college and to conduct extension work in apiculture throughout the state. A building is needed in which equipment for demonstration and instruction can be stored and exhibited and to provide class room and laboratory facilities.

14. **Physical Education:**—The rejection of large numbers of young men, appearing for induction into the army during the late war, as partially or totally unfit physically for military service, has emphasized anew the importance of physical training for young men. College athletics are no longer considered merely as sports but as a means of arousing interest and participation in games requiring skill, physical fitness and endurance.

It is the aim of the physical director, not alone to develop teams for participation in intercollegiate contests but also to encourage each individual of the student body through inter-class games to engage in at least one out-door sport. It is impossible to carry out this program at present on account of the limited area assigned for athletic purposes. Funds are needed for the grading and improvement of land which will provide an athletic field of at least twice the present size. The installation of a swimming pool is needed to complete the equipment of the gymnasium.

SUMMARY.

Needs of the College for buildings and improvements and requests of the Trustees for appropriations for the two years 1921-23:

1. Science Hall	$594,080
2. Faculty Cottages	62,000
3. Dairy Husbandry Department	
a. Barn for Young Cattle	30,000
b. Replacement of Refrigerator Equipment	6,000
4. Forging Shop and Equipment	25,000
5. Carpenter Shop and Storage House for building supplies	21,500
6. Dormitory for Men	250,000
7. Improvement of land	6,000
8. Farm Department	
a. Cottages for employees	16,000
b. Storage shed for tools and machinery	12,000
c. Tractor and tools	2,600
d. One-ton motor truck	1,800
e. Repairs to farm barns	7,000
9. Coal Bunker and Freight House	
a. Coal trestle with hopper and necessary approaches, complete	47,200
b. Storehouse with unloading platform, side track, and entrance drive connecting to state road	20,000
c. Wire fence around property at coal trestle	6,000
d. Coal pocket and boiler house, Storrs	25,000
Total	$1,132,180

Attention is invited to the reports of the Director of the Experiment station and the Director of the Extension Service, to the reports of the Pilgrimage Committees and to the financial statements that appear on the pages following.

Respectfully submitted,

CHARLES L. BEACH,

President.

THE EXTENSION SERVICE.

The Extension Service of the Connecticut Agricultural College is maintained for the purpose of aiding farmers and home-makers in the solution of their problems. The County Farm Bureau is a part of the Extension Service Organization.

The Staff of the Extension Service consists of Specialists in Agriculture and Home Economics, County Agricultural Agents, County Home Demonstration Agents and County Boys' and Girls' Club Workers. They are men and women trained by practical experience and scientific study. These workers spend their time on farms, in homes, at group meetings, holding short courses, giving lectures and conducting demonstrations. In agriculture their teaching includes maintenance of soil fertility, crop production, better methods of live stock raising, poultry raising, dairying, orcharding, bee keeping, control of insects and diseases, and efficient farm management practice. In home-making the work consists mainly of child health work, proper nutrition of the family, care and renovation of clothing, preservation of home-grown products, home labor-saving devices, managing the household budget economically, and planning household work to economize on time and energy.

The Extension Work with boys and girls is carried on in both agriculture and home-making. The aim is to stimulate in the young people of our rural communities a proper appreciation of country conditions for the highest type of home and community life, and the advantages of farming as a business. It is not only accomplishing this aim, through teaching better home-making and better farm practice, but the successful achievement of the young people is an object lesson which is having its effect on their elders. The Extension Work with boys and girls is the most vital work that is being carried on.

The Extension Service employs specialists in the following subjects: Farm Management, Dairying, Fruit Growing, Crop Production, Poultry Raising, Sheep Husbandry, Swine Raising, Vegetable Gardening, Bee Keeping, Marketing and Co-operative Organization, Clothing, and Nutrition. These specialists are available to those who desire help. To obtain the services of the specialists, request should be made through the County Farm Bureau workers or direct to the College.

Each county has a Farm Bureau with a staff of workers who devote their entire time to the work in the county. The Farm Bureau is supported by State and county appropriations, the State Agricultural College, the United States Department of Agriculture, and by membership dues. It is governed by a board of directors, selected from every town within the county. The Agricultural College co-operates with the Farm Bureau officers in directing and supervising the work of the county agents. The staff of the Farm Bureau endeavors to reach all sections of the county, and to assist local communities in working out their home, farm, and community problems. The specialists supplement and assist the county workers.

This system of Extension Work, which is now well established in Connecticut, is being carried on to a greater or less extent in every State in the Union. It is a national system. No other country in the world has such a complete and well-planned working organization for solving its agricultural and home-making problems and improving its rural life conditions.

A detailed report on the activities of the Extension Service will be printed as a separate.

Respectfully submitted,

H. J. BAKER,

Director.

Report of the
STORRS AGRICULTURAL EXPERIMENT STATION.
For the biennial period ending November 30, 1920.

A report of the Station work for the biennial period ending September 30, 1919, has already been published in the Report of the Station.

Since that report was issued no new projects have been undertaken, because of the straitened financial condition of the Station.

The projects which had been previously undertaken, however, have been actively carried on and are yielding satisfactory results.

In the work on contagious abortion, the study of possible infection through the food has been nearly finished and the other channels of infection are now being experimentally studied.

The studies of control of black-head of turkeys have indicated considerable success, a flock of 200 birds being grown to maturity.

The major project of the poultry department is on the inheritance of fecundity in hens.

The data collected in the last nine years in connection with the egg-laying contest are now being statistically analyzed by arrangement with the Institution for Experimental Evolution at Cold Spring Harbor, New York.

A determination of the normal growth curves of Barred Rocks and White Wyandottes is in progress.

During the last year the Station poultry flock has been moved to new and more commodious quarters, which will make the experimental work much more satisfactory.

Besides the study of contagious abortion noted above, in which the dairy department cooperates with the bacteriologist, the department is undertaking a test of the feeding value of ensilage from three kinds of corn, an early, a medium and a late maturing variety. This will include a study of all costs involved in growing and preparing crops, as well as of their efficiency in milk production. Three experimental silos have been erected and filled with the silage to be tested.

A study is also being made of methods of fermenting milk with the *Bacillus acidophilus*, which may be practicable for commercial plants. The product may be used as a beverage, like butter milk, and has also been shown to have therapeutic value.

The testing of small grains, the study of the value of soy beans grown with corn for silage, and the experiments on the fertilizer requirements of potatoes, which have been carried on for some years are now yielding results of great practical value.

A bulletin on fertilizers for potatoes has recently been published.

Strain tests and degeneration studies with potatoes, culture trials with alfalfa, studies of dairy farm rotations and an investigation of the availability of soil potash are now being carried on.

A study of the place in rotation for applications of manure, the reinforcement of manure with phosphates for corn, oats, and hay, and an extensive experiment on pasture improvement are newer undertakings.

The results of the work of the Zoology Department on the individuality of the hen in relation to incubation have been published in bulletin form.

In a flock of 64 ewes and lambs the effects of the stomach worm have been studied as shown by weight, effects on the blood and by mortality.

It has been determined that the immature worm can survive the winter in Connecticut pastures.

Various control measures are being tested on different groups of these sheep.

The above presents only an outline of the principal projects included in the Station work of the last two years. Space forbids any detailed discussion of them or of their practical results and value to the farmers of the state.

Respectfully submitted,

E. H. JENKINS,

Director.

Part II.

INTRODUCTORY.

The Trustees of the Connecticut Agricultural College appreciating that the demands for service on the institution were becoming greater and more varied each year, and that there was a limit to the possibilities of meeting the legitimate requests, by formal vote last spring, invited nearly one hundred citizens of the state to make a careful study of the college. They were informed that they would be asked to make an investigation of the college in all its aspects, its work, its policy, its needs, its equipment, and that this would involve more than a passing glimpse such as could be gained in one day.

Except for eight women, selected because they represented various significant local organizations, the delegates invited to take part in the Pilgrimage were appointed by different state-wide institutions as follows:

Alumni Association	eight men and eight women
Farm Bureaus of the State........	eight men and eight women
Editorial Association	eight delegates
Head Masters Association..........	eight delegates
Home Economics Association....	eight delegates
Manufacturers Association	eight delegates
State Board of Agriculture and Several State Agricultural Associations	eight delegates
State Chamber of Commerce....	eight delegates
State Grange	eight delegates

More than sixty of those invited to attend came to the college on the last Wednesday in May at their own expense and spent the day in organizing for the study, in inspecting departments and in preliminary committee work. It is significant that of the nearly one hundred persons invited not one refused to serve though many were unable to attend the first meeting.

At this first gathering of the Pilgrimage, fourteen departmental committees were organized and each was requested to prepare a report for the Executive Committee of the Pilgrimage; the Executive Committee was requested to summarize these several reports for presentation to the Trustees.

The several committees, of seven each, were appointed as follows:

Administration and Library.
Agronomy and Agricultural Engineering.
Animal Husbandry and Farm.
Dairy.
Experiment Station.
Extension Service.
Farm Management and Agricultural Economics.
Home Economics.
Horticulture, Forestry, Vegetable Gardening, Landscape, Apiculture.
Mechanical Engineering.
Academic Studies.
Poultry.
Science.
Student Activities and Accommodations.
Executive.

Each committee was informed that every aid would be given it in its work, and that "no doors would be shut." For their guidance a brief summary of the work of the college was prepared for the use of all. In addition a special summary of the departments involved was prepared for each committee and a faculty consultant appointed to serve each committee in any way possible.

The several committees organized promptly and many began their work at once. Many committees have made repeated visits to the college to carry on their work. The service that these committees have rendered has been very great and the spirit with which they took up their work has been most inspiring to all concerned. Their reports have proved so helpful and suggestive that they are printed herewith together with the materials prepared for the several committees as a background for their studies. These appear in the following order:

A brief summary of the college—the Task in Brief.
Special reports for the several committees.
Reports by the Pilgrimage Departmental Committees.
Report of the Executive Committee.

THE TASK IN BRIEF.

The Connecticut Agricultural College, as the Land Grant College of the state receives federal appropriations in addition to state support. By state law it must offer courses for men and women, and because of federal support, it must give work in Mechanical Engineering as well as Agriculture and Home Economics. Under the Congressional Smith-Lever Act it must maintain a division of Extension Teaching in order that the state may avail itself of Federal Smith-Lever funds for such work. It has also been designated by the State Legislature, under the Congressional Smith-Hughes Act, as the state institution for training teachers of agriculture and home economics.

It is therefore under obligations to train farmers and workers in the field of agriculture, to give an adequate course in Mechanical Arts that will prepare students for more advanced work in technical institutions, and, in addition to training women as teachers of home economics, must give them as adequate a training for farm home life as is given to young men, for the future development of rural life in Connecticut depends not only on a successful agriculture, but on the maintenance of a satisfied and prosperous rural people. To this end the College has contributed its best, and the large proportion of its students (63 per cent.) now engaged in agricultural pursuits is a witness to its success. But new times have brought new demands far beyond the ability of the college, and this is true in each of the three divisions of the college; Instruction, Experiment Station and Extension Service.

INSTRUCTION DIVISION

In the instruction division, the facilities of class rooms and laboratories are so taxed that the efficiency of the teaching is greatly weakened. Accommodations intended for a maximum enrollment of one hundred students are but a makeshift when three hundred have to be taught and permits no further expansion in enrollment. The necessary development of new subjects to keep the offerings anywhere near to meeting the advancing demands of agricultural instruction has meant new instructors and new courses of instruction. This has made it impossible to maintain adequate offerings in the fundamental academic subjects, without a working knowledge of which no man or woman is trained for life work. Owing to lack of funds the resources of the library cannot keep up with the requirements for books of reference, technical reference volumes for student use, technical periodicals, to say nothing of the inadequate facilities of the library rooms.

The deficiencies in laboratories, laboratory equipment, class room accommodations and library facilities are more than matched by the inadequate living accommodations for students and unmarried instructors. Owing to the loss of Grove Cottage by fire in 1919, not only the dormitory accommodations for young women were seriously curtailed but laboratories and equipment for home economics were lost. Since that time the women students have been housed in two old buildings and very uncomfortably. Temporary accommodations for class and laboratory work have been improvised in other buildings, sorely needed for the purpose for which they were built.

The cooking classes for instance have been held in the Poultry Building, a half mile from the dormitories. The dormitories for boys are housing double the number of students for which they were intended. Four boys in a room intended for two is more than a matter of physical discomfort. It makes it difficult for the students to study with the concentration they should and deprives the young men of one of the greatest benefits that comes from college life—that of living with a chum for four years.

Owing to the pressure on living accommodations the college is limited in its growth, it cannot take in all the worthy students who apply. An increase in dormitory facilities must be coincident with any expansion of laboratories and class rooms beyond that necessary to train three hundred students.

The community at Storrs must be self-sufficient. No outside housing is available. Unmarried instructors, and the necessary clerical and stenographic staff must be accommodated in rooms here and there, or in faculty houses, thus using accommodations that might be available for students.

Equal difficulties are met in maintaining an efficient teaching staff and their intensity increases constantly. So keen is the competition for trained men in agriculture that all over the country commercial organizations, banks and state departments are calling to their service college instructors and extension service men in large numbers, and at highly increased salaries. In one year, we have lost nine of our much valued men, six of whom have gone to other colleges at salaries we could in no way meet. In addition several more have received calls to other institutions, but have remained with us at a financial sacrifice because they wished not to leave work unfinished.

Recent statistics in reference to the men that have left one branch of the service of the U. S. Department of Agriculture, show that the average gain in salary for 160 men was $732 for the first year. We cannot maintain an efficient staff at the present salary schedule, which was adapted to lower living costs, and which includes no perquisites. Furthermore, owing to the war, interruption of the flow of young men into the service of agriculture has been curtailed and it is no longer possible to find adequately trained young men for our teaching departments; and it should be frankly recognized that men are no longer turning to teaching as a profession to the extent that formerly obtained. The salary question is a serious one and must be met promptly or our offerings and standards will suffer seriously. Today we have several vacancies in the instruction and extension staff that we cannot fill for lack of cardidates at the salary we can offer.

THE EXPERIMENT STATION

The Experiment Stations at Storrs and New Haven are the foundation on which all agriculture in Connecticut depends. Their duty is to solve through experiment and research the technical difficulties which are limiting production, and wherever possible to anticipate demands by determining principles of practice before errors have been made. The work of the college instruction departments and of the extension specialists, as well as the practice of the successful farmers, is absolutely based on the scientific results of the Experiment Stations. The distributors of knowledge and information look to the Experiment Station as their source of power and truth. Some problems can be solved elsewhere and be applicable to Connecticut, but many of the problems are distinctly local and must be solved locally. The Storrs Station has long specialized in animal diseases and on certain crop and soil problems for which their location or the available personnel particularly fitted it. The scourges of contagious abortion in cattle and of white diarrhoea in chicks, to mention two lines of work on which the Storrs Station has recently made significant contributions, are annually producing a loss of thousands of dollars to the farmers of Connecticut. Experiments with varieties of field and silage corn, with methods of potato culture and soil management have already produced far reaching results.

Owing to the limitations in funds ($15,000 annually from Federal sources and $12,500 annually from the state) the experimental work at Storrs must largely be conducted by those who are primarily teachers. Progress is slow and much necessary work cannot be undertaken. For instance, several years ago the Connecticut Dairymen's Association made formal request of the Storrs Station that it carry on a series of feed trials that would determine the relative values of different types of silage, and of different roughages in cattle feeding. Owing to the lack of equipment and staff this vitally important phase of investigation has not yet been begun. The Experiment Station, often considered an incidental member of the state agricultural forces, is the foundation stone, and agriculture can advance no faster than the Experiment Station can furnish the necessary knowledge for guidance.

THE EXTENSION SERVICE

The Extension Service, the newest of the triumvirate of college divisions, was inaugurated in 1911, with a small special appropriation for extension work in fruit culture. By the passage of the Federal Smith-Lever Act in 1914 its possibilities were greatly enlarged, but so enthusiastic and universal has been the call for service in this as every other state, that today the Extension Service in Connecticut cannot meet the demands upon it.

The Extension Service is charged with the duty of carrying to the people the latest in theory and practice that will help in the development of rural life and industry; it acts as a clearing house for exchange of valuable ideas and experiences between the several sections of the state; it has cooperative relations with the eight County Farm Bureaus of the State, each of which maintains a staff of practical and trained men and women to work with the people of the county in solving their pressing problems of production, conservation, marketing and of the household. Through its specialists in several fields of agriculture and home economics, it furnishes the county workers and people with expert assistance on the farms and in the home. Its service is to the whole state and to each community in the state. It is a personal service that has brought great results, as the summary of its accomplishments and activities clearly shows.

The cooperating Farm Bureaus supported from private, county, state and federal funds are today the biggest force accomplishing immediate results the country can show. The Extension Service is a nation wide organization, recognized as the most significant and most promising educational force ever devised, and is being copied by other nations and countries. If all progress toward higher ideals and better social conditions depends on an increasing economic surplus, as is generally recognized, then the Extension Service is an invaluable force in public welfare, for it helps people and communities make good. It gives people a new vision and a new confidence, it helps all other lines of endeavor and is more than a present help in trouble.

The Extension Service in Connecticut, more than any other department of the college, is feeling the competition of commercial organizations for men. Its workers must be practical minded and experienced in practice as they are sound in theory. These are the men sought as special "Extension Workers" by breed associations, fertilizer associaations and similar organizations.

Today we have no Extension Agronomist (one of the most important cogs in the agricultural wheel) because no sufficiently trained man can be found at the salary available. We need a man to devote his whole time to the important fruit industry in the state; we have no one to assist in the swine department; the vegetable growing industry has been wholly neglected; the rapidly growing beekeeping industry is only partially helped, and the whole field of farm mechanics, so necessary now, owing to the high price and scarcity of farm labor, has not been touched—all because of lack of funds, and because it was considered wise and beneficial to try to do a few things well rather than to scatter the funds over more projects, and hire second rate workers.

In order to be most efficient, the Extension workers must travel widely and practically all the time. Their work is in the field and not the office or class room. They travel the year round because for four months in the winter they spend most of their time in Extension Schools in different communities in the state—Extension Schools have proved themselves, wherever held, both in immediate and permanent results.

The cost of travel and of maintenance away from home is still rising rapidly, so that the funds that might be available for the work must be drawn to meet these necessary expenditures. The Extension Service is an institution of itself that requires special study to be understood fully, because it is so closely related to the Federal Government and the state on one side, and the local community groups and County Farm Bureaus on the other.

EDUCATIONAL POLICY AND LARGER NEEDS.

The Trustees have endeavored to develop an institution for training the youth of the state in agriculture, mechanic arts and home economics that would give as good under-graduate training as any institution of its size. They have not established new departments for the sake of completeness or for any possible advertising value. They have limited the offerings to the essential work for the adequate preparation of youths in the fields indicated. A comparison with several other similar institutions, with equal facilities and income, will clearly indicate that there has been no undue expansion in the courses of instruction and even that several desirable fields have been omitted.

Whether a direct result of the policy or not, the college has gained an enviable reputation for the quality of its instruction and for the soundness of its work. Beyond the state borders it is considered generally one of the leading agricultural colleges in the east, comparing more than favorably in the quality of its work with some institutions that are supported by much larger funds and that have more ambitious courses of study.

The development of the field of agriculture and home economics has been rapid. New phases of this subject have lately become so prominent that this reputation cannot be kept unless we can maintain adequate courses in all the essential phases of work within the required scope of the institution. We need the facilities for better and more complete offerings in several fields. The work in English and Journalism is very inadequate. Our graduates who have taken up work that requires oral and written publicity testify to the inadequacy of their training in the fundamental tool of all subjects, and for all people—English. Economics and Industrial History are today necessary subjects in the training of all, and we should be able to furnish them if we would give our young men and women a proper back-ground for effective growth.

Today the success of most agricultural operations depends on better marketing conditions. The field of Agricultural Economics, Economics and Marketing must be developed, for the demand both of the times and the students cannot be ignored. The advance in these fields is so rapid and their importance is so great that the workers therein must have adequate time for growing with the subject. Agronomy and Farm Management are growing and developing with nearly equal rapidity and these departments need greater facilities. The whole field of agriculture and the basal sciences is everywhere being reconstructed and any institution for agricultural training must be elastic in plan, responsive and forward looking in spirit. It must be vibrant and not static, ready to serve and give only the best.

The field of Home Economics is a new field, but it is as important as agriculture, perhaps even more important—for health is essential to sanity, strength, success and progress. The practice of cooking, sewing, housewifery, is dependent on nutrition and dietetics, as these are on chemistry and bacteriology—on design, economics, accounting and other related fields. The field of dietetics and household art, of house construction, of sanitation and of marketing, need immediate development if we are to meet our obligations for training young women as well as we would train men for their chosen life work. To develop with the times in these fields is essential to continued efficiency and confidence. What is now is not necessarily what must be in the near future.

SUPPORT OF THE COLLEGE

For the biennial period ending June 30, 1921, the following appropriations are available:

State, New Buildings	$200,121
Water Supply (1-2 of $130,000)	65,000
County Scholarship	4,000
To match Federal Smith-Hughes	15,327
Maintenance of College	160,000
Storrs Experiment Station	25,000
Extension Division in order to make Federal Appropriation available	134,300
	$603,748

FEDERAL

Morrill Fund, College	$100,000
Land Grant, College	13,500
Smith-Hughes, for training teachers	15,327
Experiment Station Investigation	30,000
Smith-Lever Act Extension Service	40,259
U. S. Dept. of Agriculture Aid for Extension Specialists and administration	41,161
	$240,247

Omitting special appropriations for buildings and water supply, the several divisions of the College receive maintenance appropriations for the two year period as follows:

	State	Federal
College	$179,327	$128,827
Experiment Station	25,000	30,000
Extension Division	134,300	81,420
	$338,627	$240,247

For every dollar the State contributes to the institution, the Federal Government contributes 71 cents, making no allowance for the annual income of $6,750 from the fund obtained by the sale of the original Federal Land Grant lands.

SPECIAL REPORTS PREPARED FOR THE COMMITTEES.

EXECUTIVE COMMITTEE.

Buildings and Equipment:—The needs of the institution for future development as suggested by the several committees will be found in their separate reports. Of the many needs of the institution, what are the most important, and what is the relative order in which these needs should be met?

Budget, Staff and Maintenance:—Owing to the many separate accounts that must be kept, because of receiving support from several Federal funds and departments, and from different State appropriations, no idea of the budget problems can be presented in brief form. Details will be shown in the official budget of the institution.

The cost of maintenance is rising rapidly and presents many serious difficulties in keeping up the plant which must be maintained efficiently because all the instruction work of the institution depends upon it. The care of orchards, gardens, and grounds, the maintenance of herds and flocks, cannot be decreased without serious financial and educational loss. The only material side of the work that is an accumulative investment, with little care or attention, is the rather extensive forest plantings on the cutover lands of the college.

Salaries must be raised in accordance with the needs of the times, as has been found necessary in all similar institutions. Otherwise we will lose an increasing number of valued and devoted teachers to other institutions or to commercial organizations which are outbidding colleges for the best men.

A recent careful and exhaustive, but rational study of the cost of living at another state university, where the costs (except for fuel, which is higher) are approximately the same as here, shows some striking facts which deserve consideration in our case.

The purchasing value of $1,500 in 1913 equals $2,815.50 in 1919.

The purchasing value of $2,500 in 1913 equals $4,692.50 in 1919.

The purchasing value of $3,000 in 1913 equals $5,631.00 in 1919.

At existing prices, a family of five, it was found could not be maintained for less than $3,432.59, with no allowance for spending any money for professional improvement, household help, for savings, for any family social life or amusements, for vacations or for an automobile. Inasmuch as teaching stagnates and standards decline, unless a teacher can have time, energy, and money for buying needed books, for keeping up with the advances in his profession, and for some relaxation, the salary question is a serious one in all institutions, and demands careful consideration.

Educational Policy:—The College conducts three types of educational work—

A. The four-year course leading to a degree in Agriculture, General Science, Mechanical Engineering and Home Economics.

B. The School of Agriculture, a two-year course, for those who cannot afford the time or the expense of the four-year course.

C. The Extension Service, which conducts all the extra-mural educational activities of the institution for adults and juniors.

Agriculture:—The four-year course in Agriculture permits specialization in Animal Husbandry, Dairy Husbandry, (Dairy Production or Dairy Manufacture), Pomology, and Poultry Husbandry. In each of the majors a certain amount of work in English, History and Economics is presented, because it is believed that they are essential parts of the education of all. These courses should be as high in quality as any of the professional courses, and they should be given by the best of teachers, for it is extremely important that students in their first year have the best of teaching. Their success and their spirit depend on the kind of a start they make. It is generally recognized by educational administrators, that only the best, the most experienced, and the most human teachers should present the beginning courses in any subject.

In each of the majors the technical courses should be of as high a quality as can be found in any similar institution. It has been the policy of the administration not to offer new fields for specialization unless adequate courses of high quality could be maintained, as it has been considered wise to do a little well rather than to spread thinly over an inclusive scope of offerings. There is a demand, and a reasonable and legitimate one, for a major in Forestry or in Forestry and Landscape, for which the college offers unusual facilities. There should be greater opportunities for concentration in Vegetable Growing, in Agronomy, and in Agricultural Engineering, in all of which the call for workers is greater than the college can supply.

Possibly the college should offer to four-year students a major in General Farming, with semi-specialization in one or more fields for those who expect to be farm operators or managers, or engage in general Extension Work. The demands for County Agents and Extension Workers are so great, and the losses of people in service are annually so high that Land Grant Colleges are being asked to offer special courses for training for such positions. Surely the extraordinarily successful County Farm Bureau Work in the country will suffer seriously unless training courses are offered soon to meet the pressing need.

General Science:—The course in General Science, with specialization in biology or chemistry, is offered for those students who desire to fit themselves as teachers in high and technical schools or for investigational and experimental work. Not every boy or girl of eighteen who goes to college knows his special bent. New interests are aroused, new points of view are secured, and new decisions must be made. It would be unfortunate if the work in the institution could not be fitted to the needs of those who find their interest to lie in some other phase of applied science than agriculture. It is the business of a College to fit men for service, each according to his own special abilities, so far as the scope of the institution will permit.

The course in General Science is a regrouping of the offerings of the college for special ends, and permits specialization in science beyond that possible for the student of agriculture. Another advantage of such a course is that it gives the teachers of science the same opportunities to carry students into advanced and technical work that is enjoyed by the several departments offering majors in agriculture. Unless a teacher has some advanced students that demand the best that he has and that cause him to grow with his subject and them, he is likely, as maturity advances, to become intellectually lazy and stagnated. An institution can only be kept alive if every atom of which it is composed is alive and functioning for growth.

The course in General Science has turned out several conspicuous men in investigational work. The opportunities of the course should be expanded as personnel and other needs permit.

Mechanical Engineering:—The course in Mechanical Engineering, leading to the degree of B. S. is planned to give boys with a mechanical interest such a course as will fit them to secure their degree in Mechanical Engineering in a technical engineering school in one year or more according to their special interests, or to become teachers in mechanical training and vocational schools. At the same time the department conducts courses for the students in agriculture that will give them the elements of mechanic arts for use in practical agricultural operations.

The course in Mechanical Engineering, now that the Mechanic Arts building will be available, can be made without much increased cost as strong and pertinent as any course in the college, and place Mechanical Engineering on the plane that is demanded of the offerings of a Land Grant College, that must offer to the students of the State, training in Mechanic Arts as well as Agriculture.

Home Economics:—The course in Home Economics, receiving support from the congressional Smith-Hughes Act, is primarily devoted to training women as teachers of Home Economics, for which the demand in the State is relatively low.

Many of our woman students are not drawn to teaching. Like the men students, they find applied science or social service arousing their interests. They desire training as dieticians, or in the scientific basis for nursing, with a view to perfecting themselves in technical institutions. Some look forward to teaching Home Economics in Extension lines; others find their interest in various lines of social service, as in Home Service work, as Red Cross workers, or in Child Welfare work. Others want that training that will make them efficient housewives and community leaders in rural communities. Increasingly, women are recognizing that a successful household is the mainspring and balance wheel of a successful farmstead. Women need to know the elements of agriculture and to secure the right ideals as to rural community life. All these fields are pressing now. Others will come as women's work widens in scope with the time.

To limit our training to restricted phases of women's work is to neglect our opportunities and to fail to make the best of our resources. Rural women workers of whatever type need the point of view and the content that can be secured only at an institution devoted to rural service. Within our scope, as in agriculture, we should train women for service, each according to her interests and needs, with no thought of expanding our women's courses to compete with the women's colleges with inclusive offerings in many unrelated fields, any more than we would expand our courses for men into lines of specialization fostered by endowed institutions. A state college for services in the three fields of agriculture, mechanic arts and home economics, and not a state university, which easily might be a poor Jack of all things and master of none, has long been the ideal of the Trustees, toward which, in cooperation with the Faculty, they have consistently worked.

The School of Agriculture:—To meet the need for a short-term training for would-be farmers and farm managers, the college offers a two-year course in general agriculture, known as the School of Agriculture. This course is open to men with practical farm experience and over eighteen years of age, and hereafter will be for a term of twenty weeks each year from about the middle of October to the middle of March. By such a time schedule it is hoped to attract both young and mature men, who can leave farm operations during the non-growing season, and for which the college formerly offered winter short courses. Owing to the limitations in living accommodations and to the lack of facilities for handling classes, the giving of the winter short courses, generally recognized as of great significance, has had to be given up at least temporarily.

The courses in the School of Agriculture are arranged so as to cover all phases of general farming, and are planned so as to give both facts and principles, as well as the power to grow with the times and analyze and apply new information as it appears. It is a practical course toward practical ends, and given as carefully and sympathetically as the courses in the College.

In many other states the work of the School of Agriculture is given in local agricultural high schools and centered about home and farm operations. This makes the work more personally practical and applicable, and permits students to secure their elementary training in agriculture without leaving home, and at less expense than is involved in attending college. It is hoped that with the development of Smith-Hughes High Schools in the state, the School of Agriculture may be discontinued. Until that time it will remain one of the most important and immediately effective lines of work the college can carry on.

Extension Service:—The Extension Service, by Federal law under the jurisdiction of the State Land Grant College, is an educational force of great moment, and one of the most potent forms of education ever devised. Its work is to help those who have not had recent training, and to give follow-up work to those who are facing new responsibilities. Its scope and its work are summarized more adequately in an accompanying detailed report. Its watchword is service, and its purpose is education in a wide sense, directed to practical ends.

Summer Use of the Institution:—For three months in the summer, formal instructional work ceases, but the farm, the fields, and the orchards must be cared for, and to meet the needs of students who remain to labor, and of others whose duties demand their presence here, the dining hall must remain open. A part of the plant is functioning, but not all. Even though it is customary for educational institutions to be inactive or semi-inactive during the summer months, is it a wise or economical policy? Most of our instruction staff is hired for eleven months in the year, while some, who are doing work for the Experiment Station, use the summer months for concentrated investigational work.

What should be the policy in reference to the use of the plant during the summer months? A four-term year seems out of the question at the present time, owing to the fact that so many of our students must return to work on home farms during the summer months, or must use that period for earning money to carry them through the year. Educational institutions are gradually changing from a two-term to a four-term basis, allowing students and staff to elect absence during any quarter of the year. This plan has many merits. If it could be inaugurated, it would permit students to engage in practical work, especially in Agricultural and Home Economics Education and in shop work. Further, it would permit our younger instructors to continue training in their specialties in other advanced institutions. If our students, or even one-fourth of them, could profitably, and without financial sacrifice be in attendance during the summer months, such a plan for the College year might be worth considering seriously. It would involve a reorganization of the courses of instruction, and promote concentration on a few subjects each quarter. It would mean greater intensity of teaching.

In lieu of such a reorganized plan for the year, what is the best use of the facilities for the summer months, and what summer service from the College is most needed?

A summer school for teachers of Agriculture and Home Economics seems not to be needed, owing to the few positions in these fields in the State. We have been requested to give a summer course for Red Cross workers this summer, and the increasing call for Home Service training may mean that such a course could be repeated at least biennially.

During the war the College was busy all summer, training people for emergency service, through canning schools and the Boys' Working Reserve.

The situation at Storrs is ideal for summer living. A summer school would add little to the cost of maintenance, and should be conducted annually if there is a call for it. Perhaps such a summer school should not be restricted exactly to the field of the institution, but the plant should be used for training various types of leaders and teachers in co-operation with other State institutions or private organizations.

Sabbatical Leaves:—Before many years the institution must adopt a policy as to sabbatical leaves, as is done in many other institutions that consider seriously the problem of assisting members of the staff to grow in wisdom and experience by occasional contacts with the best sources of power and strength. A sabbatical leave with pay (either one year out of seven, or a half year at the end of every three and a half years) is not a device for giving increased vacation. It is expected that a person on sabbatical leave will devote most of his time to study or investigation.

Sabbatical leave should be a right for all, and not a special privilege granted to those who have become worn out in the service. It should be primarily a method of helping the strong become stronger, in order that the standards and ideals of teaching in the institution may ever be strengthened.

Summary:—The demands for the training of leaders in agriculture and Home Economics far exceed the supply, and are increasing constantly. We are called upon each year to fill many times the number of positions for which we have trained graduates. Training for leadership in rural life is our special field of effort, to which we must offer our best or fail to be of the service to the State that public welfare demands. Leaders must be practical men, and practical men become leaders if they catch in their school and college training the spirit of service, the right ideals towards life, and are trained in the elements of leadership. To give this outlook, and to inculcate such a spirit is the goal of the College and the instruction staff. The success of any institution depends on the quality as much as on the quantity of training given its graduates. To such service the College is devoting its full energy, and that it is to a degree succeeding is indicated by the reputation it has without as well as within the State.

ADMINISTRATION AND LIBRARY.

The college must maintain many facilities for the benefit of all, and must perform many functions for the welfare of the work as a whole. The business side must be handled efficiently and promptly, student records must be kept accurately, the administrative officers must have the facilities for handling their tasks without waste. Buildings must be heated, lighted and kept in repair, roads and grounds developed, and maintained, and last but not least, adequate library accommodations furnished, for there can be no education without books, and books so housed and managed that they can be used.

During the last year important improvements for service have been made, in the building of a much needed infirmary and dining hall and in the building of a few cottages that have relieved, but by no means eliminated, the pressure for living accommodations for members of the staff.

The most needed increased facilities are described below, but not necessarily in the order of their relative importance.

Administration Building:—The present Main Building is a versatile and hospitable old wooden building, that includes under its roof many offices, class rooms, and laboratories, and the Library, most of which should not be housed in other than a fire proof building. It cannot be dispensed with or turned to more reasonable uses, until a new building is provided. This should be a fireproof building, placed to fit the general plan of landscape development, to accommodate the business offices, offices of administration, the Post Office, and offices for the Directors of the Experiment Station and Extension Service. It might include temporary accommodations for the library.

Dormitories:—Fifty applicants were refused admission this year owing to lack of living accommodations. If the College is to meet the legitimate demands upon it, there should be provided at once a Woman's Building, which should be a dormitory and a center of all Home Economics work, and at least one dormitory for men. Two men's dormitories are really needed now. These dormitories would make it possible to accommodate nearly double the number of students now accommodated with little additional cost for maintenance or instruction provided the rooms for instruction purposes could be increased in the near future through the building of a Science Building.

Cottages:—The College now owns thirty-one cottages which are rented, and return an income of 7% on the investment. As building sites cannot be leased on the State property, and the instructors thereby encouraged to assist in securing living accommodations, houses must be provided by the Trustees. The faculty and staff are mostly young men, just starting home life. If we are to maintain an efficient teaching staff we must furnish living accommodations that will foster the development of home life and good community life. Although new cottages have been built during the year, we still, as always, have a long waiting list for possible houses, and cannot keep up with the reasonable requests. Furthermore the large and necessarily growing secretarial and clerical staff must be housed and cared for. At present many are living in private rooms that could be used for young women who would help pay their way through College by helping in families.

Maintenance:—The state appropriation is used to pay the salaries of officers of administration, of employees not engaged in instruction, for repairs of buildings, care of grounds, heating and lighting, freight, cartage, and insurance, and for other general maintenance costs.

Owing to the increased cost of labor and supplies, and especially to the increased cost of fuel, the cost of maintenance is rising rapidly—too rapidly to avoid a deficit in this department.

Owing to the war, improvements and repairs to buildings and grounds were reduced to an essential minimum. As a result there is a great need now for painting and minor repairs; what might be called preventative repairs. For the last few years it has been possible only to attend to urgent matters of upkeep, and preventive repairs, which are always the best of economy, have had to be neglected.

We need an increase in the maintenance fund for buildings, and a storage house and repair shop for the use of the building department. The storage of lumber, paints, and parts for the upkeep of the buildings is a serious matter, and facilities should be adequate so that supplies can be bought in quantity and housed.

The planting of ornamental trees should be resumed, not only for landscape effects but to perfect the equipment for landscape instruction. The rough places about the newest buildings should be planted and our roads should be made more permanent and less costly for upkeep. The new entrance to the grounds that must follow the building of the new state road from the west, will necessitate new roads to the campus. The portions that are to bear heavy motor traffic should be made permanent, and facilities should be available for efficient repair.

Campus lights for dark nights, especially in winter, should be provided as soon as possible. At present our only illumination for safety in walking is furnished by the front porch lights of the thoughtful members of the Faculty. A few near-danger spots are never lighted, but accidents have fortunately been avoided so far.

It would add materially to the beauty of the attractive campus and save damage to the ornamental trees if the unsightly poles for lights and telephones could be replaced by conduits.

The questions of labor, of housing of tools, and of a more efficient method of removing ashes, garbage, and rubbish need consideration. The time is rapidly approaching when rubbish and garbage must be burned, and no longer dumped as is now necessary.

The College woodlands have been planted in pine and spruce so far as possible. The seventy acres now planted should be increased gradually for economic as well as artistic reasons. This work can be adequately maintained at an annual cost of not over $500, and would be an investment that would bring in money to the college in a few years.

Handling Supplies:—One of the largest elements in the cost of maintenance is the transportation and hauling of coal, grain, and other supplies. The cost of hauling is great but will be somewhat reduced when a permanent state road to the west is built as was directed by the last General Assembly.

The cost of handling should be reduced by mechanical means so far as possible. This is especially true in the matter of coal. Facilities for storing a year's supply of coal at the Central Heating Plant should be furnished, and of a type that would permit the dumping of the coal direct into pockets from which it could be carried by truck to the boiler doors. Such a coal bin could be built for about $9,000, and would save at least $1,000 annually in labor.

It would help in the cartage problem if, when the new state road is built, there could be a storage house at the railroad, in which grain and incidental freight could be stored, thereby often saving demurrage, and carted when it best fits into other farm operations. The economic maintenance of necessary farm teams depends in large part on furnishing work at times when farm operations are least pressing.

· **Library:**—The Library contains approximately 15,000 volumes and is wholly inadequate in its facilities for being used as a workshop,—as a library should be. Further, it is housed in an old wooden building, and twice the books have been laid out on the campus because of fire. A third move might not be so fortunate. The present library room adjacent to the busy central offices, does not furnish the quiet or opportunity for application that a library should.

The library staff includes a librarian who teaches seven hours a week, an assistant, working thirty-three hours a week, and a student helper for twenty-two hours a week.

The library cannot be kept open for as many hours as it should be, especially on Saturday and Sunday, unless more help is available.

The first need is more room. Every available spot is now used for storage, and reading accommodations are constantly being restricted accordingly. A library is more than a repository; it must be a service station. Temporary storage and special reading rooms could best be supplied by using the rooms, now an apartment, immediately over the library.

A library building, with adequate stacks, that could be used for departmental seminar rooms for advanced students with adequate reading and reference room accommodations for at least four hundred students, is much needed. This building should architecturally be one of the dominant buildings in the college group for a Library is the basic educational facility in any college.

Many of our departments are more than weak on current and standard publications, without which no real education is possible. The Extension Service should have a special alcove for the great amount of new material constantly appearing all over the country, and which is all pertinent at least for many months. The same thing is true of the several departments of science, of home economics, of economics, marketing and agriculture, in all of which the newest and latest publications must be available for real educational work.

The maintenance of the several departments of the library in an adequate way would require at least $8,000 for new materials at once, with at least $3,000 a year for purchase of new publication.

It should also be borne in mind that the prices of periodicals (and there are many technical periodicals that must be at the service of the students) has increased recently, as has the cost of binding.

These needs are not suggested with a view to developing here a great all-round library, but are what is really necessary to make the college function in its several departments as a real educational force.

AGRONOMY.

Agronomy includes the sciences of soils and field crops brought together under one department. For convenience, the work in Agricultural Engineering is included in this department. The elementary courses are prescribed in the course in Agriculture and the more advanced courses are practically prescribed in one or more of the several majors.

The offering of advanced courses is restricted to those crops that are important in Connecticut Agriculture, and may be divided into cash crops and forage crops.

Teaching:—The teaching work is carried on by three members of the staff, but owing to other duties in investigation and administration of two, this is equivalent to two whole-time teachers.

Investigation:—The equivalent of the time of two men is devoted to experimental work in Agronomy, as a part of the work of the Storrs Experiment Station. About fifty acres of land are devoted to experimental crops, especially to the question of rotations for dairy farms, corn variety tests (carried on for a series of years) feeding value of types of silage corn, and methods of growing alfalfa, all problems on which Connecticut farmers are seeking light. In addition an extensive series of pasture improvement experiments has been started with an endeavor to find the best methods of reducing the cost of producing milk in summer.

Experimental plots, of which we have twenty-two, must be handled with much more care than demonstration plots, for all chance of error must be eliminated. The experiments under way are time-consuming but distinctly worth the investment in time and money.

Extension Work:—The extension work of the department includes advice to county agents and farmers on planning crop and field demonstrations, in giving personal advice on crop and fertility problems, and in the matter of selecting seeds adapted to local conditions.

In the winter months the Extension Agronomist is busy four days each week for four months in the four-day extension schools held in the several counties in the state. This is one of the most important and practical forms of work the department is called upon to carry forward.

There is an increasing demand for expert advice in the field of agricultural engineering both from farmers and farm women. The planning of farm buildings, water, light and heating systems, the selection of farm equipment for special purposes and questions of drainage are constantly being referred to the department for assistance.

Help is given so far as possible, but a man for extension work in this field is seriously needed really to give the service the times demand, and for which the calls are becoming more numerous constantly in these days when every farmer is studying his methods to decrease cost and increase efficiency.

Equipment:—The instruction department is fairly well equipped for carrying on the elementary courses, but not for advanced work. More room and more equipment is needed, which can only be furnished when the Agronomy building is built. One wing of the proposed building, for which plans have been in hand for some years, is now used for the work in Farm Machinery, and temporarily houses the offices of the Extension Service.

The cost of maintenance apart from salaries is as follows:

College—labor, equipment and supplies	$1,900.
Experiment Station,—labor and supplies	4,600.

The equipment used for instruction, including furniture, is valued at $9,073. The experimental work has the use of a small old barn, and has equipment and tools valued at $1,700. Money was appropriated a year ago for the building of some experimental silos for feeding trials, in association with the Dairy Department, but owing to the loss of the barn by fire these trials had to be postponed. The silos are on hand and it is hoped to have them in operation this winter.

Needs:—The special needs are a well trained experimenter who can devote all his time to following up experimental work; an extension agronomist who can carry on the much needed field work; a station barn (vermin proof) for the storage of grains and crop products, from the experimental fields, and a suitable laboratory for analytical work.

A small greenhouse is needed for instruction in soil fertility in the winter months, especially important for the men in the School of Agriculture, who are only here during the closed season.

As the demands in the teaching force increase, a soil man will need to be added. We also need a permanent teacher in agricultural engineering, a field in which few have had expert training and where, therefore, the supply does not equal the demand.

ANIMAL HUSBANDRY AND FARM DEPARTMENT.

The maintenance of a successful animal husbandry department that will adequately give training in the breeding and management of horses, beef cattle, sheep and swine involves, of necessity, an extensive investment in stock, buildings and grounds, and the production of a large proportion of the roughage needed for winter feeding.

The farm department in addition performs a similar service for the dairy department, selling hay and silage to that department, and buying back manure, and produces the roots for the poultry department. The management of the college farm is vested in the head of the Animal Husbandry Department. The college farm also furnishes a large amount of the team labor used in several College Departments.

The organization centers about the instruction work. Stock for demonstration purposes and study is of course necessary. Our horses, sheep, beef cattle and swine are not fancy-priced stock. The individuals have been well selected, however, and the college has won an enviable reputation for its breeding work shown both by the sales of foundation animals to other institutions and to private breeders, and by the success in the show ring in the last few years.

With the renewed interest in livestock on Connecticut farms, at least in certain adapted sections, there has been an increase in the instruction called for and in the department for service.

Teaching:—The teaching is in the class room, barn and judging ring. The head of the department, owing to his large amount of administration work on the farm, and being in charge of the Gilbert Farm at Georgetown, regularly conducts but one course through the year. The remainder of the teaching is done by one man who devotes one-half his time to Extension Work.

Extension Work:—The full time of one man and half the time of another man is devoted to sheep extension work among sheep farmers in the state. This includes the breeding and management of flocks, docking and shearing demonstration, assistance in the marketing of wool, and instruction at Institutes and Extension Schools. It is made possible by a special appropriation for sheep work of the last legislature and its effectiveness is indicated by the demands upon the men involved. Already the number of sheep has been greatly increased, and the quality of the breeding stock much improved, owing to the assistance given by the college.

Needs:—With the large numbers of livestock and dairy cattle owned by the college, all bred and developed for a purpose and scientifically, we need a trained veterinarian for service and to give the class instruction in the College and School of Agriculture. More assistance will be needed on the instruction side if the demands on the department continue to increase as they have in the near past. A judging pavilion for all classes in animal judging is almost imperative. With classes of fifty or over in the winter season, a properly arranged room with ring large enough to hold several animals and with raised seats is the only way in which the work can be handled efficiently. To judge one animal at a time, in a closely packed room, gives no opportunity for real teaching of judging or any emphasis of comparisons between animals. Such a building would probably cost at present about $20,000.

The remaining first needs are additional facilities for carrying on farm operations economically. They include (1) a storage shed for implements and tools, which now cannot be housed from the weather, and so built as to include a blacksmith and repair shop and a garage for the farm truck; (2) a stable and shed for the equipment at the

Rosebrooks Farm; (3) a hay loader, threshing machine, side delivery rake and tractor.

With the increase of the land devoted to buildings, the tillage land has had to be developed at a distance from the barns, thereby increasing greatly the labor costs of the farm operations. Money is needed for draining and bringing into productive cultivation some 15 to 17 acres back of the dairy barn and nearly 20 acres at the Rosebrooks Farm. At an expense of a little over $5,000, the land for tillage and cropping could be increased by from 30 to 35 acres and the farm would have greater unity and be more efficient.

With so large an enterprise as this and with the demands upon the farm changing so rapidly, improvements are constantly necessary. It is unfortunate to have to follow farm practices which we would criticize as unsound and labor-consuming on other farms. The college farm should not only be a productive farm, but one so organized and systematized that it can be a demonstration farm for the students in all courses in the college, and especially for those studying the principles of farm management.

DAIRY DEPARTMENT.

The dairy department, in addition to its work of instruction, of investigation and for the Extension Service, is charged with the development and management of the dairy herd, both for teaching purposes and production, and with the handling, sale and manufacture of the dairy products of the herd. The creamery maintains a milk route for the community, for which it has to purchase a portion of its milk. The budgets for the herd and creamery are conducted separately. Forage is bought from the farm department and manure sold to the farm department. The milk is sold to the creamery from the barn, which in turn handles and markets it and does a business of more than $35,000 annually.

It is the policy of the dairy department to maintain a pure-bred herd in each of the four significant breeds and to breed and develop them for increased production and as an illustration to students of the best methods of herd development and handling,

The instruction work in milk production and handling therefore centers about the herd and creamery, both essential elements in the equipment.

Teaching:—The teaching work demanded by the two majors in dairying—dairy production and dairy manufacture and milk supply—and by two full-year courses in the School of Agriculture, done by one man who devotes one half of his time to teaching, and one on three-fourths time. The remainder of the time is devoted to investigation and to administration duties.

Investigation:—In addition to the time devoted to investigation by the two members of the teaching staff, one man is employed for full time, on Experiment Station funds, one for investigational work and another as supervisor of Advanced Registry work. This involves checking up the tests and submitting reports to the Breed Associations. At present 32 herds in the state are carrying on yearly testing and during the year ending March 31, 63 short-time tests were conducted. The number of farm supervisors of tests during the year ranges from 5 to 18.

Three continuing investigations are under way. Preliminary returns on the first two have been published in bulletin form. These are on abortion and calf feeding. Such investigations can only be really productive of good when they are continued for a long period. The silage feeding demonstration will be begun this year to determine the relative feeding values of mature and immature corn.

Individual work has been begun on the use of fermented milk in controlling intestinal diseases, on the heat coagulation of milk, and certain technical details of ice cream making. These are all so important that they should be pushed rapidly. A research laboratory and certain apparatus is needed to carry on these researches in a thorough manner.

Extension Service:—The time of one man is given to Extension work, in the helping of farmers, singly or in groups, to make their breeding more worth while, their feeding more economical and to make the dairy business successful. A monthly feeding ration service is maintained that is given statewide publicity, and in the winter the extension schools consume a large amount of time and contribute more effectively to dairy improvement than any other form of extension work.

The Extension Dairyman and the head of the department are called upon for much work in judging at fairs in the falls. At present, attention is being given especially to the promotion of the nation-wide Better Sire Campaign and as a part of that work much personal assistance is given dairymen in the selection of breeding stock.

Equipment and Expense:—The teaching work and the commercial work are housed in the basement and first floor of the dairy building. The herd is kept in the new cow barn, and the young stock during the past winter has been kept in barns at Spring Hill. The total value of stock and equipment, not including the barn or bull pen, is $20,500.

Inasmuch as the creamery and the herd cannot be conducted purely as business propositions, because of teaching demands upon them, a small budget over receipts is required in each division. This amounts to $10,000 annually and should be increased by $3,000 if the herd is to be maintained as it should be for demonstration and instruction purposes. The expense this year has been large, owing to the loss of the barn and contents just at the close of the haying season. The expenses of the experimental work, exclusive of salaries, is $3,450. This does not include the Advanced Registry work, which is self-supporting.

Needs:—The first need is a barn for young stock. The present cow barn will only accommodate 48 mature animals and more are needed—and the barn under construction is purely for storage. About $1,800 is needed for fences and grading near the barns, and the machinery for manufacturing and experimental work is decidedly incomplete. This includes an ice cream freezer, machinery for refrigeration and other research equipment.

In addition, at least one man and two graduate assistants are needed for instruction and the commercial work.

STORRS EXPERIMENT STATION.

1. **General Policy:**—The Storrs Station confines its work mainly to the investigation of problems in animal industry. The work is carried on in six departments: Poultry Husbandry, Dairy Husbandry, Animal Diseases, Agronomy (with special reference to the production of food crops for stock), Economic Zoology as related to animal parasites, and Chemistry.

The investigational work in poultry has been insignificant, especially that dealing with white diarrhoea in chicks, the investigations in inheritance and of the limiting factors in incubation. At present promising results have been secured from the preliminary work on blackhead in turkeys.

The work in animal diseases and especially in contagious abortion has produced results of great significance to the dairy interests of the state and which have brought an enviable reputation to the Storrs Station. This work is not finished and must be continued to be of the greatest benefit.

The work in dairy husbandry involves certain technical problems in milk production and handling, and practical tests of feeds, which it is hoped to begin this year—a series of investigations for which the dairymen have been asking for some years. The handling of official tests of the several breeds is also the responsibility of the dairy department.

The crops problems of the agronomy department involve the growing of crops under careful, scientific conditions on the fields to the south of the college grounds, and the laboratory study and comparison of results in the winter months.

The work in economic zoology has already produced valuable results in reference to the control of horse and cattle lice and other animal parasites. At present the chief attention is being given to the study of the stomach worm of sheep, one of the chief deterrents to the development of the sheep industry in Connecticut.

Without a very large increase in funds any considerable extension in the number of departments of work is inadvisable. Any reasonable increase in funds should be used to strengthen and enlarge the present departments rather than to undertake quite new lines of work.

No Station can cover the whole field of investigation, and concentration on a few problems increases efficiency.

The above plan avoids any duplication of the work which is done at the Connecticut Agricultural Station in New Haven, and also the friction and criticism which might result from duplication.

Since the loss of the College laboratory, the chemical work of this station is done at New Haven; the chemist, Mr. Edmond, being paid in part by this Station and in part by the New Haven Station.

Members of the Station staff, with five exceptions, are also professors or assistants in the College, and in most cases their salaries are paid half by the Station, it being expected that their time and energy will be divided in the same ratio.

Present Equipment and Value:—The Station has the use of a small office building containing a library consisting mainly of Station publications. The contents of the building are insured for $2,720.

It also has a storehouse for filing its publications and for mailing.

The Poultry Department of the Station is accommodated in a College building. It owns no buildings but has its own flock and office equipment, two being valued at $2,558.50.

The Agronomy Department has the use of some 50 acres of College land and of a barn and tools and office equipment valued at $2,313.25.

The Dairy Department is in a College building, has its own office equipment and the use of the College herd for feeding and other tests, and owns some stock which is under test in experiment work. Its property is valued at $1,391.

The department of Animal Diseases carries on its work in cooperation with the Dairy Department and Poultry Department. The laboratory work is done during the summer in the College laboratory, and at other seasons at the Sheffield Scientific School in New Haven.

The Zoological Department occupies a room in a College building and has no other equipment than that furnished by the College. For work on sheep it has at its disposal a small flock of sheep which is kept in an old barn near the Apiary. This work has been made possible by special appropriations of the last legislature.

Annual Expense of Maintenance:—The estimated income for the present year is as follows:

From the United States, Adams and Hatch Funds....	$15,000
From the State of Connecticut..	12,500
Miscellaneous Receipts (and balance on hand)..........	8,452
For Sheep Investigation	2,000
	$37,952

The budget of expenditures for each department including salaries is as follows:

Administration	$2,890
Agronomy	8,800
Animal diseases	3,050
Chemistry	1,150
Contingent	1,547
Dairy	8,365
Poultry	8,625
Sheep investigation	2,000
Zoology	1,525
	$37,952

Of this amount over one-half is expended for salaries of experimenters and for clerical assistance.

Needs:—Each department, and especially the Dairy, Animal Diseases and Agronomy Departments, is hampered for lack of funds most effectively to carry on its work. The first and greatest need of the Station is an increase in the general appropriation. An increase from $12,500 to $20,000 in the annual appropriation is no more than sufficient to meet necessary increases in salaries and to provide equipment and supplies for the work of the departments.

The Station also needs buildings for its use. A barn is quite desirable for the Agronomy Department, possibly with a small stable for animals isolated from the College herd for experiment.

At some time the Station should have a building, or a section of a building, for its exclusive use. In it there should be a director's office; storage, filing and mailing room or rooms; and a dryer and chemical laboratory for the work incidental to the several departments. It is desirable that this should be centrally located. It would seem that a wing of a College building, perhaps of an Agronomy Building if such a building is put up, might be the best arrangement because most of the work of the chemical department would be connected with that of the Agronomy Department.

EXTENSION SERVICE.

The Extension Service of the Connecticut Agricultural College, although established in 1911, did not begin to function actively until 1914, when the Federal Smith-Lever Act, appropriating funds for Extension work, went into effect.

The Smith-Lever Act provides for co-operation on the part of the Federal and State Governments, working through the State Agricultural College. Since every State in the Union has accepted the provisions of the Smith-Lever Act, there is now established a national system of Extension teaching in Agriculture and Home Economics, of which the Extension Service of the Connecticut Agricultural College is a part. The Smith-Lever fund is paid directly to the College, but its expenditures are supervised by the United States Department of Agriculture. In other words, the expenditures from the Smith-Lever money have to meet with approval of the Director of the States Relations Service of the Department of Agriculture. The funds received from the Smith-Lever Act and from the United States Department of Agriculture constitute in this state about one-half of the total expenditures for extension work.

Administration:—The Connecticut Agricultural College and the United States Department of Agriculture have a general memorandum of understanding (in fact all states have a similar memorandum of understanding) which provides:

1. That all Extension Work in Agriculture and Home Economics carried on within the State of Connecticut by the United States Department of Agriculture shall be done in co-operation with the Connecticut Agricultural College Extension Service.

2. That there shall be employed a Director of Extension work who shall be a joint representative of the College and the United States Department of Agriculture, and who shall have full responsibility for the administration of co-operative Extension work in Agriculture and Home Economics within the State. The Director of Extension, however, is employed by the Trustees of the college, receives his salary from State Funds, and is responsible only to the President of the College and the Board of Trustees; he is not under jurisdiction of the Department of Agriculture.

3. Each line of work carried on co-operatively by the College and the United States Department of Agriculture is planned through a project agreement mutually acceptable to both parties. Once the project is agreed to, the administration of the work comes under the State Director of Extension.

The Extension Service has co-operative relationships with all departments of the college. The department heads are responsible for the subject matter taught in Extension. For example, the teachings of the Extension Poultryman must meet with the approval of the head of the Poultry Department. This makes for harmony within the department, and insures the farmers of receiving reliable information. The Extension Poultryman is responsible to the Extension Director for his time and expenses, method of work, and co-operation with other members of the Extension Staff.

Weekly reports are required of all members of the Extension Staff, one copy of which is sent to the head of the department, one copy to the Extension Director, and one copy retained for the worker's own files.

The three State Leaders, who supervise County Agent Work, Home Demonstration work, and Boys' and Girls' Club work respectively, are responsible to the Extension Director. Their salaries are paid jointly from Federal and State appropriations. The State Leaders, in addition to their weekly reports, make a monthly report summarizing their own activities and those of the agents under their supervision, a copy of which is sent to the Washington Office.

Monthly, and frequently semi-monthly, conferences of all Extension specialists and State Leaders are held to discuss agricultural policy and programs, methods of conducting the work, and co-operative relationships. The Extension Director holds frequent personal conferences with members of the Extension Staff and with heads of the various departments. These conferences serve to keep the work of the entire State Extension Service, including the Farm Bureaus, co-ordinate, and they avoid overlapping and duplication.

A yearly report of all Extension work is required by both State and Federal Laws.

Finances:—The following table shows the amount of money appropriated for Extension work in the State, including Farm Bureau Work, from State, Federal, and County appropriations and Farm Bureau subscriptions, for the five-year period 1915-1920:

	State Appropriations to College and Farm Bureaus	Federal Appropriations to College and Farm Bureaus	County Appropriation and Membership Dues to Farm Bureaus
1915-16	$7,500	$18,900	$10,700
1916-17	15,500	22,700	30,800
1917-18	48,000	56,000	61,000
1918-19	58,000	93,000	84,300
1919-20	89,800	41,500	51,000
	$218,800	$232,100	$237,800

In 1919-20, 42.1% of Extension funds appropriated to the College by the State and Federal governments go to the support of Farm Bureau work, 57.9% of Extension funds from State and Federal appropriations support Extension Specialists in Agriculture, in Home Economics, in Marketing, in Editorial and Publicity Work, Extension Schools, Farmers' Institutes, Fair Exhibits, Administration, and miscellaneous work.

Distribution of expenses for the year ending June 30, 1920:

Salaries	$115,724
Travel	38,260
Other expenses (office rent, equipment, supplies, fair exhibits, extension schools, Farmers' Institutes, contingent)	28,316
	$182,300

Organization of Work:—The work of the Extension Service is divided into five main divisions—(1) County Agricultural Agent Work, (2) Home Demonstration Agent work, (3) Junior Extension or Boys' and Girls' Club work, (4) the work of Specialists in Agriculture and Home Economics, (5) Marketing.

County Farm Bureau Work:—The first three lines of work are headed up in each county through a County Farm Bureau organization which is co-operative with the Extension Service. Each Farm Bureau has a board of directors, of one from each town in the county, (some counties have two directors from each town, one man and one woman), the regular officers, and an executive committee. The executive committee is the directing body of the Farm Bureau. This committee meets regularly, looks after the expenditures of the Farm Bureau, hears reports from the County workers, discusses desirable lines of work, and looks after the problems of finance and organization. The Director of Extension, or his representative, attends the executive committee meeting of each Farm Bureau, and all other meetings of the officers or board of directors. The Farm Bureaus had a membership of 8,076 men and women in 1919. The members elect their directors and officers at the annual meeting.

Approximately one-half of the salary of each county agricultural agent, home demonstration agent, and county club leader is paid from the Federal Extension funds, made available to the county farm bureau through the co-operation of the Extension Service. Each county in the state now has a farm bureau. There are eight county agricultural agents, seven home demonstration agents, and four county club leaders. The Extension Service provides state-wide supervision of the county workers, maintaining a state leader in each of the three lines of work being carried on by the farm bureaus.

The total contribution of the Extension Service to the support of farm bureau work for 1920 is as follows:

County Agricultural Agents	$19,460
Home Demonstration Agents	15,588
Junior Extension	13,832
Total	$48,880

In addition, the county workers, as well as the state workers supervising the county work, have the federal franking privilege, which means a saving of several thousand dollars a year.

Specialists:—Agricultural specialists are maintained in farm management, crop production, dairying, poultry, sheep raising, fruit growing, and beekeeping; and there is also an agricultural editor.

Farm Management:—Farm management extension work is conducted so as to assist farmers in making their farm methods and practices better adapted to the changing economic conditions. This includes a study of the cost of production for various crops with a selected group of farmers about the state, assistance in keeping, analyzing and using effectively farm accounts, and the distribution of the facts thus gained to others through extension schools, talks to farm groups and by means of the press. A great deal of time is given to helping county agents with the problems presented to them by farmers.

An account book has been prepared and is in wide use, and by the close of the season much valuable information will be available for general use from the farm studies now being made. Farmers are alert to the needs of changes in their methods to meet new and unexpected conditions, and farm management extension work is in great demand because the help that can be given is both timely and good.

Crop Production:—At present we have no extension agronomist, owing to our inability to get a qualified man for the salary available. The problems of soil fertility and crop production are so fundamental in all agriculture that this lack is keenly felt. The questions of better home grown roughage, of the best varieties of corn for silage in different sections of the state, of the increased use of legumes, of pasture improvement, of better use of fertilizers and lime, are all being shown through demonstrations in the several counties, and to the effectiveness of the work the extension agronomist has in the past contributed greatly.

Dairying:—Dairy extension work is conducted in close co-operation with farm management and crop production, so that the plans for improving our dairy returns may have unity and be wisely outlined. As his special field, the extension dairyman gives individual assistance to farmers in their problems of breeding and herd building, to the elimination of unprofitable producers, to the use of purebred sires, and the control of contagious diseases.

Sheep:—Through the act of the last legislature, appropriating $10,000 annually for sheep work by the college, the Extension Service has been enabled to push work with sheep during the present year, using about one-third of the appropriation. This includes giving help in securing breeding stock, assisting farmers in their problems of flock management, and the control of diseases. Docking and castrating demonstrations and shearing demonstrations are held, and assistance given in the marketing of wool.

Fruit:—The great fruit industry of the state opens a field for extension work of great importance. Thus far we have been able to have only one man on one-fourth time to meet demands. It is hoped by the autumn to have a man on full time, who will help both the small farmers who raise fruit as a cash crop and the commercial growers as they would be helped.

Bees:—The teacher of bee culture devotes one-half time to extension work, and has helped more than 1,300 beekeepers in the state materially during the last few months, which have been serious ones for the bee industry. This help has been in securing and distributing sugar for winter feeding and assistance in winter and spring care of swarms.

Poultry:—The accomplishments in poultry work have been of outstanding significance for several years, especially in testing birds for white diarrhoea, in selecting laying and breeding stock, in culling flocks, in feeding for egg production, in the organization and follow-up work of poultry clubs, and in the Home Egg Laying Contest. In this over 46,000 birds are now entered. Two men devote all their time to poultry extension work.

Agricultural Editor:—A publicity department was organized during the war, and proved so helpful that it has been maintained. The editor gets out a weekly press sheet for the press, edits all extension publications, co-operates with county agents in their farm bureau papers and other publicity, and prepares material of current interest and importance for the agricultural and secular press.

Specialist in Home Economics:—The Home Economics Specialist's time is largely devoted to extension school work, institutes, fair exhibits and talks to farm women on request. A part of the time of the Assistant State Leader is given to assisting the county home demonstration agents in their child welfare work.

Marketing:—Extension work in marketing is relatively new but has proved of great importance both to producers and consumers. Many co-operative farmers' associations have been formed, both for buying and selling, much advance has been made in the development of better rural credit, and a market information service is being conducted in the four largest cities of the state. This work originally started by the U. S. Department of Agriculture, has been continued by the Extension Service through special funds made available by the Board of Control, because of the appeal made by interested farmers and the State Board of Agriculture.

Club Work:—One of the most significant forms of work of the Extension Service is that with boys and girls in the clubs in vegetable growing, in the raising of pigs, sheep and calves, in poultry keeping, in garment making, and in other household activities. This work has greater potentialities than any other because it is with the rural people of the future. The success of these clubs has been very great both educationally and financially and it is to be regretted that owing to lack of funds several counties have been obliged to drop it, at least temporarily. The detailed report of the progress and success in this field shows a splendid result in capitalizing and directing youthful interests toward useful and profitable ends.

The Extension Specialists, including specialists in agriculture, in marketing, and in home economics, work co-operatively with County Agricultural Agents, Home Demonstration Agents, and County Club leaders. The County workers have to deal with all sorts of agricultural problems, and of necessity must be men and women who possess knowledge of general farm and home problems. They cannot be experts in all lines of agriculture and in all phases of home making work. Specialists, therefore, are an essential part of an efficient Extension Service. In fact, County Agricultural work could not long survive without the help of strong subject matter men and women.

Furthermore, all the Extension Specialists take part in such work as Extension Schools, Farmers' Institutes, and assistance to fairs through exhibits and judging, and in an advisory capacity to their officials. County workers, with knowledge of local conditions, and intimate acquaintance with the people of their county, and Extension Specialists, with thorough knowledge of their respective subjects, make for effective teamwork.

Extension Schools:—Extension Schools of four days duration have been conducted in the State every year since the beginning of organized Extension work. The schools have been one of the most significant pieces of work of the Extension Service. The communities in which they have been held have been stimulated to adopt better farming and home making practices, which have resulted in a definite program of work: but even more important than the improvement in agriculture and home making, the Extension School has aroused a community spirit. The staff of the Extension School, made up of specialists and county workers, lives in the community for four days, and become acquainted with the local people and local conditions. The schools are held during the winter months, when farmers and their wives have time to attend such meetings and when plans for the next year's work are being considered. The minds of the people are in a receptive condition. Some of our most constructive and effective Extension work has resulted from Extension Schools. This year fourteen schools have been held with an attendance of 500.

Farmers' Institutes:—Farmers' Institutes, one of the oldest methods of Extension teaching, still hold an important place in this state. They afford an opportunity for farmers and farm women to come together to discuss their common problems with one another and with the visiting speakers. The institutes are helpful not only in teaching them improved farm and home practices, but also in strengthening faith in their business and in their community, which perhaps is even more important.

Fair Exhibits:—The Extension Service devotes a great deal of time to the preparation of educational exhibits and to attendance at fairs with these exhibits. Last year two exhibits—one occupying a tent 40x80 feet, and the other a tent 40x60 feet—were sent to seventeen fairs. In addition to the exhibit work, the College provides a great many judges to fair associations. This year an attempt is being made to give special assistance to one real agricultural fair in each county, in an endeavor to make our small rural fairs a part of the agricultural program of the county, and of greater educational value.

Immediate Needs of the Extension Service:—Due to withdrawal or lack of funds, several lines of work which proved highly valuable during the war have been dropped. This is especially true of Home Demonstration work in cities, for which Smith-Lever funds cannot be used. The home work in cities should be developed, both for the sake of the health and welfare of the consuming public and for the benefit of the producers. The matters of undernourishment of children, of the right use of food materials, of conserving clothing, and all the problems of maintaining personal health, are community problems and not individual problems.

City Home Bureaus, organized along the lines of the County farm bureaus, such as exist in New York and Massachusetts, would contribute to the public good as the county farm bureaus are doing, and could carry on work with foreign groups and others that we know from our experiences in the war is much needed and much appreciated.

We also need a specialist in clothing to assist the county home demonstration agents in their conservation problems. In fact, in time, special assistance in the several phases of home and community work will be as necessary as in agriculture, if our rural life is to be built up in a unified way. The farmstead, and not the farm, is the unit area for the farm group. Help to the housewife is an economic and social necessity, as much as to the farmer.

We need a full time man for beekeeping, a growing and important industry in the state. We have no one to help on the problems of commercial vegetable growing, which are now so numerous and which are a public concern. We can give only casual assistance to the important swine industry and to the farmer or farm wife who is asking help on the problems of heat, light, water, drainage, better use of labor saving machines, and other problems in farm and home engineering.

Correspondence Courses will some day be necessary if follow-up work is to be conducted as it should be and people are to be helped as their initiative warrants.

Finally, the demand for trained and practical extension workers is so great, not only by educational institutions but by commercial organizations that holding good men at the salaries we can offer is difficult. The salary schedule in several fields must be raised if we are to maintain a personnel of the individual strength the work demands. No inexperienced men are acceptable to farmers in this work, which is so personal in character.

POMOLOGY, VEGETABLE GROWING, LANDSCAPE, FORESTRY, AND APICULTURE.

The several departments grouped for special investigation by this committee have many common factors and many necessary interrelations. Each department has a producing as well as an instruction function. Instruction would be of little value without the producing end, which can be used for practice and demonstration, and which incidentally brings in a certain amount of income.

The department of Pomology has twenty-five acres in plantings, including a ten-acre commercial orchard, a variety apple orchard, a variety stone fruit orchard, a dwarf orchard and a vineyard. The annual income is about $3,500, but allowance should be made for a vast quantity of fruit stolen each year, in part by those who think this is a State institution and therefore its crops are public property.

The department of Vegetable Gardening has about seven acres in plantings and a greenhouse (18 ft. x 70 ft.) for instructional work in the winter months in general vegetable growing under glass. The income from sales is about $1,000 a year.

The department of Landscape and Floriculture maintains greenhouses for instructional and demonstration purposes, and uses the College layout of grounds for the same work.

The department of Forestry has planted about 70 acres of the cutover lands to varieties of pines and spruce, both for demonstrational purposes and as an investment for the College. The standing hardwood is being sold to the Faculty, a little each year, each person doing his own cutting and paying a moderate stumpage cost.

The department of Apiculture maintains thirty colonies of bees for educational purposes, from which it is expected that the returns will continue to increase in importance.

Department of Pomology; Teaching:—The courses in the department are planned to train the commercial orchardist, and owing to limitations in personnel and equipment it has not been possible to develop courses for those who would take up orcharding as a cash crop on dairy and poultry farms. A course is given in the School of Agriculture for a year along similar lines to that in the regular course.

Investigation:—There is no investigational work being done in Pomology. We have the orchards and the facilities. Fruit growing in the State is an industry of increasing importance. The problems in Pomology that need investigation are many and urgent. We need the equipment, the funds, and the personnel for carrying on investigational work of the highest type.

Extension Work:—The teaching member devotes one-fourth time to Extension work, which can only be answering calls for help as they arise, and giving courses in Extension Schools and Institutes. We need a man of the best of training and of wide practical experience for Extension work in producing, grading, and marketing fruit, as soon as the necessary funds can be secured. The fruit industry deserves first consideration in the fields of Extension work not yet adequately covered.

Needs:—The department needs more room for teaching, which it is hoped may be secured in part by the building of a Science building that will relieve the pressure on the Horticultural Building. Improvements and drainage in the basement of the building would make space available for laboratory work in spraying, grafting, etc.

In personnel the department needs at least one man in teaching, one man for experimental and investigation work, and one for Extension work.

A larger fund is needed for maintenance of the orchard and vineyards, owing to increased cost of supplies and labor. The plan for orchard development permits an expansion of plantings to about forty acres, close to the present orchards. This would be commercially worth-while, but would involve clearing and fitting new land, for which labor and funds are not available.

As the orchard is developed, an implement building will be needed near the orchards, and more equipment added totalling in all about $7,000. A combined storage plant for the vegetable and Pomology departments is seriously needed, for the storage of staple products that should be marketed at the top of the market. At present the facilities for storage do not permit scientific or efficient marketing.

Connecticut fruit growing is one of the leading agricultural industries of the State. The College should be able to contribute to the development of fruit work much more significantly than is possible with the present equipment and facilities.

Department of Vegetable Growing:—The teaching work of the department includes vegetables and small fruits, and has for its purpose the training of persons to take up commercial work, and to give students in agriculture and in the School of Agriculture the practical knowledge necessary for success in vegetables as cash or home production crops.

The principal need is for a development of the work in small fruits, and better facilities for handling students taking the vegetable courses, which must of necessity be carried on largely in the non-growing season. The present facilities will not adequately accommodate the number of students seeking instruction. More efficient opportunities for instruction in the department would bring to us students now going out of the State for training that we could furnish.

Landscape and Floriculture:—It is the policy of the department to fit men for work on private estates and parks, and to enter commercial work in floriculture and landscape, as well as to give students, who do not intend to specialize in the field, that outlook and training that will enable them to make the surroundings of their homesteads and farmsteads more pleasing.

The head of the department devotes one-fourth of his time to teaching. The remaining three-fourths of his time is given to superintending the upkeep of the grounds and greenhouses.

Needs:—The chief need of the department is for more greenhouse room in which teaching work and investigations could be carried on. Owing to the decrease in supply of foreign gardeners, there is an increased demand for training in this country. To carry on adequate instruction calls for greater facilities, for at present classes must be limited in numbers. A greenhouse at least 200x25 feet should be provided. The economic return from such a greenhouse is worth considering for the market for flowers and decorations is constantly increasing, and could be developed so as to make use of the output of the plant.

Forestry:—The teaching work in forestry is given by the Assistant State Forester on one-half time assignment, and has been devoted to training men to handle farm woodlot problems. Owing to the development of estate forests, especially in the western part of the State, there is now a need of training men for such work, and for portable saw mill logging. Probably ten to fifteen men a year would take such a course, which would also train them to become professional foresters after a short finishing course in a Forestry school.

The expense for equipment for such a course would be less than $4,000, which could be divided over at least three years. The course would call for an assistant and a small fund for maintenance. The development of State and private forests in the State would seem to warrant such a course, the larger part of the equipment for which is found in the existing College plantings, supplemented by the accessible State parks, in which practical work could be easily conducted.

Apiculture:—There is an opportunity for the development of beekeeping in the State by at least three-fold. Owing to recent State legislation, bee culture has been materially fostered, and Connecticut is organized to give practical instruction in bee culture as are few States. There is an increasing demand from men and women for bee training.

The teaching work and the management of the apiary is done by one man, who devotes one-half his time to Extension work.

Equipment and Expense:—The equipment of supplies and bees is valued at about $2,000, housed in inadequate quarters. The expense of maintaining the department, apart from salary, is less than $1,000 a year, with no allowance for income from sales.

Needs:—There is great need for proper laboratory equipment and storage facilities, and facilities for the winter care of bees. This could best be furnished by a building, which would also accommodate instruction, a departmental library and office rooms. An assistant in apiary work from May 1 to October 15, would not only be a help to the work at the College, but would give the head of the department greater opportunity for developing Extension work.

The bee Extension work has been so much in demand for the last year that it needs the full time of one man, and the industry warrants the service.

COMMITTEE ON ACADEMIC STUDIES AND EDUCATION.

The function of the college course is the development in selected individuals of more than ordinary native endowment of those capacities and powers by which they can be most successful and contribute most as trained specialists to the welfare of the community and the state in which they live. The present work of the college of agriculture is the training of experts in the technique and technology of the occupation of agriculture, of the sciences which lie back of agriculture home economics and engineering, and of home economics and mechanic engineering themselves. But whether the student is to be specialist, teacher, or leader in the improvement of country life, the professional aspect, the need for adaptiveness in dealing with men and with ideas looms large. For widest service to the state it is hardly to be questioned that the chief present function of the college is the development of unusual capacity for leadership in the affairs of farm life and of the home. It is then the duty of the college to furnish means by which the student may find himself. It must consider the welfare of the student as well as of the state which maintains and gives sanction to its work. Certain of the studies taught by the departments concerned are direct instruments to vocational efficiency. This is particularly true of language. English is a first means to understanding and expression. The expert, the demonstrator, the investigator, the teacher, the leader in rural life or the farmer in the smallest community, if he lack a ready, apt, and correct knowledge of the English tongue, is measurably handicapped at the very start, and throughout his career.

Journalism is a vocation in itself, and knowledge of the use and resources of the press is distinctly contributory to the success of the leader in almost every field of effort. A knowledge of how to make publicity either through the newspapers or the technical journals is important to every trained worker. Spanish is often of first value to the technical expert, particularly in the promotion of improved economic and social relations with the countries to the south of us—a field in which it is reasonable to expect that certain of our students may find a useful place. German is a means of access to an organized technology in the fields of agriculture and engineering and to recondite and valuable sources in the physical and biological sciences. French gives access to the contributions of French genius in the studies of physiological and social science.

The demand for economic knowledge is so great at present that our colleges have been robbed to meet the needs of industry. It is the back-bone of the training of all workers in the rural field. For those who go out into agriculture, into industry, into home and institutional management, a clear understanding of the principles of economic law and of their application is of great importance.

Sociology is now the back-ground for the interpretation of economic phenomena. For leaders in country life, sociology and rural sociology form the core of content in their vocational training.

History gives a basis of interpretation of modern economic and social conditions and forms a necessary part of the training of every forward-looking person. The studies in education are vocational in their nature, but offer, as well, opportunity for the student, who has not yet found himself, to explore one more field of occupational activity. Academic courses are valuable in other ways than as a contribution to vocational success. They serve, as in the case of language, to open fields of enjoyment and appreciation apart from the interests of the vocation itself; they possess, as in the case of literature, values intrinsic and worth-while in themselves. The specialist is a man as well as a social servant. Again they serve, as in the case of history, sociology, and economics, to give back-ground, proportion, the sense of relative values in the affairs of life, without which the life of the specialist is narrow. They add to the resourcefulness of the individual in meeting new situations in life. In other words their value is liberalizing. In the range that they cover, in the phases of life that they touch, in the problems that they raise, in the attitudes that they stimulate, well taught courses in social science, in literature, in history, are hardly to be surpassed in the field of college work.

This is the purpose and the reason for academic courses in a technical institution. Certain of the courses are equally important in the School of Agriculture, and two-year courses in English and a course in history are required in that course.

Teaching:—The courses of the several departments are described in the catalog. The courses in English are given by a man on full time, and an instructor who devotes part time to English, part time to German, and the rest of the time to Library administration. The course in Journalism is given by the Agricultural Editor who devotes most of his time to Extension Work.

The course in history is given by a man on part time; the courses in modern languages take the full time of one man. The courses in economics, apart from agricultural economics and marketing, described in another report, are given by a man on full time. The same thing is true of the courses in Education and Sociology.

NEEDS OF THE DEPARTMENTS:

English:—The course in journalism might well be associated with the English department and more training given in practical English, including news writing.

There is need for a larger staff that would make possible more personal work with students who need help in perfecting their English which to many is merely a natural tool which they feel needs no sharpening. As a matter of fact for many students English is a blunt tool or even a bludgeon which has no cutting or driving power.

History:—The work in history should be developed to include modern industrial history and recent world history perhaps in association with economics. Closely related to this combined field should be a course in social ethics which would give students the right attitude toward local and world-wide political, civic and moral movements.

Education:—An increased staff and better facilities for practical and teaching work are essential. The Home Economics students can get practice in high schools. A similar opportunity should be available for men in the Smith-Hughes agricultural high schools. To develop this work, as it should be developed would require a special person to supervise apprentice teaching in agriculture, and one for home economics, being responsible also for teaching the methods in these subjects. A special class room for practice teaching of educational psychology is much needed because this subject must be taught in part through materials.

A consolidated school, including a Junior High School, would give the college much needed opportunities for observation and practice, and would give the community adequate educational facilities, the lack of which may soon be a cause for losing some of our younger members of the staff.

Finally an organization into divisional unity, under a committee and dean or director, as in the case of the Science and Agricultural Departments, would contribute to the efficiency and the "esprit de corps" of the "academic staff," and to the dignity and standing of their work for the college; a divisional and, to some extent, a departmental recognition of needs for room and equipment, so soon as such can be provided, would be a powerful means to increasing influence among the students; a definite assignment of office room and clerical help would add greatly to the comfort and efficiency of a heavily loaded teaching body. Departmental offices, including small departmental libraries; a stenographic office, with a mimeograph, and at least one competent full time stenographer for the division, would save much time and release much energy from the routine occupations to which now the members of the staff must give themselves. The instructor's time spent in clerical work is expensive time for the state. The instructor who must work in his bed room or in the family sitting room is handicapped in the task of high grade teaching.

The several members of the staff appreciate the overcrowded and under-equipped condition of the college as a whole, and the pressure which has driven the academic teaching into the fringe and corners of curricular activity. But they feel that a policy which looks forward rightly to adequate housing, equipment, and staff maintenance in the important fields of Agriculture, Science, Mechanic Arts, and Home Economics, should not overlook the material needs of departments, which, if less directly concerned with vocational efficiency, yet contribute in their teaching so much of increased adaptiveness, of motive, insight, and appreciation of the implications of vocation, and that broadened fringe of experience which makes the vocation life.

HOME ECONOMICS DEPARTMENT.

The policy of the Home Economics Department in recent years has been to train teachers of Home Economics, the college having been designated by the Legislature as the institution to receive Federal funds for that purpose under the terms of the Act of Congress known as the Smith-Hughes law.

The opportunities for Home Economics teachers in the state are limited by the demands of the teaching positions available, and for these relatively few positions several private institutions are conducting courses of training. Many of the girls who come to the college, and the number is constantly increasing, are attracted to other phases of the ever-expanding field of work for young women. To train students for other positions than those in teaching seems a duty that must be adequately met in the near future.

Being an institution dedicated to the betterment of rural life, it would seem as if one of the first duties of the college is to train women for living in rural communities as efficient and progressive housewives and as community leaders who will help upbuild the rural social conditions of the state.

For those who do not look forward to home making, many opportunities for service are open, for all of which the college is equipped to give at least the foundational training.

The demand for hospital and institutional dieticians is constantly increasing, positions for which the fundamental courses are available at the college. The more technical courses should of course be taken in practical institutional work.

The opening up of Home Service work by the Red Cross, calls for a new field of training for rural work, a field peculiarly appropriate to the college, and for which the request has already been made.

Visiting nurses are increasing in importance and the demand for trained nurses will continue to increase. The preliminary training is pertinent to our field of effort, preparatory to technical work in hospitals.

Club workers, home demonstration agents and other types of extension workers are in demand far exceeding the supply. If the work so well begun in our counties is to be continued, trained women with a sympathy for and an understanding of rural life must be supplied in increasing numbers, for the term of service of the average woman worker in such fields is short. The demand constantly exceeds the supply.

These are a few of the lines in which we are called upon by students and the public to contribute to the service of the state. Under existing conditions our teaching must be practically confined to training teachers of Home Economics. Shall we meet these calls for service? If so we must increase our teaching force, though the new courses that would need to be offered are relatively few.

Teaching:—The courses offered are those essential for a teacher of Home Economics—cooking, sewing, textiles and design, dress making, millinery, household management, marketing, home nursing, social and industrial history and house construction. In addition, the students carry on practical work in the Practice House, and during the last term of the senior year, engage in practice teaching under supervision.

Equipment:—The equipment, exclusive of the dormitories, is valued at $1,400; and the annual cost of maintenance, apart from salaries, is $2,150. About two-thirds of the cost of all maintenance is met from Federal funds, and practice house and the course in advanced cookery are practically self-supporting. To develop the lines of work not possible under the Smith-Hughes funds would require increased support for personnel and a few new courses.

The development of the department to meet the demands of the times, and in a way to grow with the future, calls for a relatively minor fund for maintenance.

AGRICULTURAL ECONOMICS, MARKETING AND FARM MANAGEMENT.

These two departments deal with those phases of agricultural science in which there is of necessity the most rapid changes in practice and in which new principles are being developed constantly. They both are handicapped by the fact that little investigation has as yet been done in these fields, at least in regard to New England conditions. They are both so closely interrelated that the principles in one are applied in the other.

Agricultural Economics and Marketing:—The instruction offered in Agricultural Economics and Marketing consists of two semester courses in the senior year. The first cover the problems of farm labor, farm credit, land problems, including tenantry, and the formation of farmers' co-operative organizations. The work is largely developed through the analysis of local situations and is planned so as to open the minds of the pupils to the importance of the economic problems involved in agricultural practices on Connecticut farms, and the bases of sound solution of these problems.

The marketing work deals with the machinery of marketing, and includes an analysis of marketing methods, means and results in Connecticut. The elements of salesmanship and advertising are included, and a basis given for analyzing the market needs and market possibilities in any community, taking into account both the needs of the producer and the consumer.

Extension Work:—The Extension work of this department includes a market information service, assistance in marketing problems, assistance to co-operative organizations and farm credit.

The market information service, begun by the United States Department of Agriculture, and continued by the Extension Service because of favorable response by the Board of Control to an appeal for the service from farmers and the State Board of Agriculture, is carried on in four cities—Bridgeport, Hartford, New Haven and Waterbury. This work is done by two market reporters, is printed in the newspapers in these cities and mailed to all interested. The work is under the direction of the Market Specialist, who also carries the extension work in market methods, inspection, transportation and standardization of containers.

The head of the department in addition to his teaching work, conducts the extension work in co-operative buying and selling and in farm credit.

Needs:—The first need of the department is to make a beginning in the investigation of the many special market conditions in Connecticut, including the marketing of cash crops on more remote general farms, the marketing of special products, the co-operative motor marketing possibilities and the distribution and character of special seasonal demands for commodities. Marketing cannot be organized on an efficient basis in Connecticut until such information is gathered, analyzed, correlated and made available to both producer and consumer.

The second need is for the full time of at least one man in teaching, to meet the increasing demand for up-to-date information on market methods and possibilities.

The third need is for an adequate reference library of all the current and standard literature of marketing and economics. The changes are so rapid in this field that students and instructors need to have prompt access to the latest literature on marketing and on applied economics. This should preferably be arranged in a reference room where it may be studied individually and used by the class for collective study in the regular class periods.

Many of the principles in both phases of this subject could be presented more effectively if there were a sufficient number of certain standard publications beyond the power of the students to purchase, so that there would be one copy for every three or four pupils. A teaching equipment of enlarged diagrams and graphs should be built up if the teaching is to develop in method with the subject.

These needs can be met at a reasonably small expense. They can be made most useful only if the department is centered in rooms of its own where the teaching material may be used out of class hours, as is the case in well equipped laboratories in science.

Farm Management:—Farm practice changes with general economic conditions and particularly with changes in relative supply and prices. The somewhat standardized farm management methods in Connecticut are changing rapidly. The worker in agriculture, whether farmer, teacher, extension worker or investigator, must be able to analyze the practices he finds on farms and test their economic soundness.

To give such an ability is the purpose of the courses in farm management, in both the required course for the second year of the College and the School, and in the course on Connecticut Farm Problems, elective for juniors and seniors.

These courses in a way unify the special courses on methods in the special departments, and give the point of view that the specialist needs if his special line of interest is to be made to fit into the general farming methods which predominate over a large part of the state.

Extension Work:—The head of the department spends three-fourths of his time in extension work, which is particularly devoted to assisting farmers in keeping and analyzing farm accounts and in modifying their practices, so as to secure greater labor income. Extension schools, special farm management schools, and talks to farmer groups all assist in making the newer methods better known. Much time is given to assisting county agents with the problems that farmers bring to them. The call on the department for service increases constantly and is state-wide. There is no phase of extension work in which farmers are more alert and demanding.

One man on full time is assisting in this work and is making careful cost studies of various elements of the farm business with selected representative farmers all over the state. This work is time-consuming but is giving immediate returns to the farmers, and through it is being gathered a body of facts that will be of benefit to all as soon as they can be correlated at the end of a year's work.

At present there is little real knowledge as to many accepted farm practices. Is it always wise to make milk through silage feeding? How much does it cost to produce the same amount of nutrients in various forms of roughage. How does the labor requirements of strategical crops fit into the farm operations? How can the farm practices on dairy and other farms be modified to make a better use of team and man labor?

Principles of farm management cannot be wholly book principles. They must be locally pertinent and economically sound for each locality and type of farming.

It is the business of the Extension farm management workers to carry tried and proved methods from section to section as fast as they are known, and to be of service to as many as possible in developing a better farm business.

Needs:—Investigational work should be conducted systematically for a period of years, if we are to have the body of facts necessary to enable us to change our farming methods in sympathy with the new demands constantly arising because of changing economic and social conditions.

The work of the department would be made more effective if time and personnel were permitted on follow-up work, with graduates who take up farming and managerial positions. This would help prevent discouragement, mistakes and inefficiency and contribute vastly to the improvement of agriculture in the state. We need a man of training and of practical experience and with sympathetic ability to understand men, who would visit beginners at increasing intervals until they had learned to put in practice the best they have gained in their college training. Such follow-up work, when tried in other educational fields, has proved highly valuable. It would tend to decrease the errors and increase the success of our graduates, who can only get confidence that makes good through experience.

The department would be able to meet the calls for the immediate future if it had a teacher, an investigator and an extension worker on full time with two student investigators in the summer. The work demands this personnel now, both in timeliness and in recognized importance.

MECHANICAL ENGINEERING.

Mechanic Arts is one of the two divisions of instruction required by the fact that we are a Land Grant College receiving a large part of our support from Federal sources. In some colleges the Mechanic Arts department has been developed more broadly than agricultural education. It is the policy at the Connecticut Agricultural College to offer only such courses as will enable the students to get the fundamentals of engineering practice, in laboratory, vocational and mathematical work so that they can secure technical training and the degree of M. E. in a technical institution at a minimum expense of time. To do less than this would be to confine the work to those elementary courses in construction valuable to the farm operator and to fail to meet the needs of the boys who are drawn to work in applied science and would not be led to enter a technical institution because of the expense involved. It is hoped that in time the work may be developed here so that an M. E. degree may be given with specialization in restricted lines.

Teaching:—The course of study described in the catalogue is all given by this department and the department of Mathematics, except for six courses in allied subjects. The work is done by the head of the department, assisted by an instructor, with four courses given by the head of the Department of Mathematics.

Equipment and Expense:—The equipment, including drawing tables, hand forges, wood working machines, benches and metal working machines, is valued at $2,612. The expense this year excluding salaries is approximately $1,000.

Needs:—The work of the department in the past has been carried on in different rooms in the older buildings and in a rented blacksmith shop with antiquated equipment. The Mechanics Arts building, which for several years has been used as a dining hall, will be available for use the next college year. This supplies the department with adequate rooms except for forging work. The latter work should be developed so that all students in agriculture may be trained in forging. This is a need that is recognized by the students, the instructors in other departments, and by those who are interested in agricultural education. Today the practical farmer and agricultural worker needs the elements of blacksmithing, carpentry and concrete work if he would be successful.

An up-to-date forging shop with modern equipment is needed badly. A building 34x66 feet matching the architecture of the Mechanic Arts building would cost approximately $10,500. Twelve down draft forges properly connected would cost $5,500.

This total investment would help the work of the other departments, whose students cannot now be accommodated because of inadequate equipment.

The equipment of the Mechanic Arts building must be increased to make it adequate. It is estimated that $6,750 would be required really to equip the building in the strictly necessary machines for elementary work in woods and metals.

The present accommodations and staff can handle sixteen freshmen and eight in each of the upper classes. Owing to the large amount of necessary shop work in the courses, with the limited staff, few sections can be handled. The fourth year of the B. S. course begins in 1921. To carry four classes of minimum size will require an additional instructor by that time.

The increasing demand for men trained in Mechanic Arts is likely to increase our number of students to the full capacity of the new building. This will obviously necessitate an increased budget for maintenance.

POULTRY DEPARTMENT.

The poultry department conceives its highest duty to the State to be training young men and young women to recognize the proper place of poultry on the farm, and not simply a matter of developing expert poultrymen, although this work is important and necessary. Connecticut has less than one hen per capita. Farm flocks may well be increased both in size and in number. This is the department's permanent policy. Our foremost food authorities have recently pointed out the lack of balance between agriculture and industry, the gradual decrease in agricultural productivity and the hazard in industrial over-development, continuation of which policy will within the next five years necessitate a far greater importation of food stuffs to supplement our own food supplies and greatly to the detriment to the Connecticut farmer on whom we are dependent for certain perishables. We are also reminded of the far more important fact that our country's chief source of social stability is the farm. The department's pressing problems, therefore, are of local significance as they contribute directly to the increase of Connecticut's agricultural wealth and economic stability.

Some Results: The following is a summary of some of the department's activities during the past five years:

1. More than 500 students have received instruction in poultry work.
2. The department has trapnested 10,000 hens that have laid 1,500,000 eggs.
3. Forty thousand hens on 150 farms in Connecticut have been tested for White Diarrhoea. Ten per cent. were found infected.
4. Fifteen bulletins and a score of pamphlets, a total of more than 8,000,000 pages, have been published and distributed gratis.
5. The department has inaugurated, and is now supervising, a home egg-laying contest in which 45,000 Connecticut hens are participating.
6. In 204 demonstrations, 32,000 hens have been culled. Over 12,000 were rejected as slackers. Feed bills on these flocks were reduced 39% while the owners only lost nine per cent. of their gross income.
7. Throughout this period, the department has conducted experiments that made possible the agglutination test for White Diarrhoea, determined normal growth curves for Leghorns and Rhode Island Reds, continued breeding Leghorns in an effort to learn how high fecundity in hens is inherited, attacked the problem of blackhead in turkeys, vaccinating for chicken-pox in fowls and many other minor experiments.

Investigation:—Like other departments of the college, Poultry Husbandry may be divided into investigational, teaching, and extension work, the respective functions of which are to ascertain, teach, and disseminate the truth. Sensational experimentation is not condoned. The department invites attention to the fact that true investigation is not infrequently a long time, tedious job, requiring the services of highly trained men who are willing to work and study for years, if need be, in the hope of finding the right solution.

Experiments may be divided into two general classes, one of which endeavors to answer as promptly as may be the farmers' immediate problems: for example, how to combat rose chafers, increase hatches and eliminate white diarrhoea in young chicks. The other group more often originates in the department and is designed to determine the profitable limits which may be expected in poultry production. In this class fall the subtler problems of breeding, statistical data collected in connection with the laying contests and in culling campaigns that have reduced the cost of production by discarding the unproductive hen. Investigation requires more than any other phase of the work perhaps investment of funds from which there sometimes seems to be no immediate return. For example, a man now believed to be one of the best poultrymen in the state has been receiving definite assistance from the department for a period of some seven years.

Teaching:—In the matter of teaching, results are not always tangible or definitely measurable. During the current scholastic year there has been an enrollment of 116 students receiving instruction in the poultry department. In 1917 the two upper classes, like those in many other institutions, largely abandoned their college work to join the army. In consequence there has been for more than two years a marked decrease in the supply of graduates and a corresponding increase in the demand for trained men. Within the last six months the poultry department alone has been asked to suggest candidates for not less than a dozen positions paying from $1,200 to $2,500 per annum. With one or two exceptions, these requests could not be met. With the present enrollment, however, and excellent prospects for a larger number of students, the department hopes presently to be able to meet requirements of this sort.

Extension:—The policy of Poultry Extension work has been primarily to increase egg production in Connecticut. The problem has been attacked in a general way by advocating the things that have to do with better poultry management, including better feeding, better housing, breeding, extension schools, grange lectures, poultry institutes, fair exhibits, etc. More especially the work has consisted of definitely outlined projects such as the institution of a culling campaign the organization of thousand-dollar poultry clubs, the elimination of White Diarrhoea in young chicks and the inauguration of a home egg-laying contest. The department has tried to be of service to the largest number of its constitutents in particular and to the people of the state in general and has believed that this could best be accomplished for both producer and consumer by increasing the productivity of hens and by showing how to make poultry keeping profitable.

Equipment:—The department's equipment consists of an office building, feed house and eighty-seven poultry houses, fifty-two of which are devoted to an egg-laying contest. The total value of all buildings, houses, yards and equipment is approximately $60,000. This does not mean that the plant actually cost this amount, for the reason that the office building, erected seven years ago, at an expense of $25,000 is now appraised at more than $40,000. The department enrolls 100 students a year. Assume the equipment to last for twenty years and tnat it costs five percent. of its value to keep in repair;

then the investment becomes sixty dollars per student with no allowance for investigational work and problems of the extension division. The present cost of maintenance, including all labor, supplies, salaries, repairs and equipment for the teaching and experimental work amount to approximately $15,000 a year. The laying contest costs an additional $9,000 but is entirely self-sustaining.

Needs:—At present the department has five men—two of whom devote all their time to Extension work. The three in teaching and investigational work devote half-time to each.

Further demands for teaching cannot be met with the present staff, in part because much time must be given to administration work incident to managing so large a plant in all its parts. Investigations have been completed in several lines and the data are available for five pertinent bulletins which cannot be printed for perhaps two years because of other insistent demands on the workers.

In addition to another teacher, there is great need of more stenographic and clerical assistance because of the great demands of correspondence incident to following up the local work in all parts of the state.

A statistical helper is needed in the investigational work to assist in summarizing the results of the contests. Foremen and laborers must be paid higher wages and the cost of maintenance is rapidly rising.

Equipment:—In the teaching side at least $1,000 could profitably be used at once in furnishing necessary desks and tables, in the preparation of teaching materials for permanent use, and in the purchase of needed demonstration equipment. The library facilities are wholly inadequate in books, reference volume and periodicals—especially unfortunate at the present time when progress in poultry investigations is so rapid in all parts of the country. Eight hundred dollars is needed at once and an annual appropriation of $200 for up-keep.

The cost of repairs and supplies has rapidly increased. While the houses are in fair shape, fifty of the contest houses should have cement floors at once. If the policy for making it possible for boys to pay their way through college by poultry keeping is wise, then at least one dozen houses are needed for this purpose. This will allow only three new boys to start on such a course each college year. Courses should be provided for standard and utility judging, in dressing for market, crate fattening and a few other subjects—all of which cannot be accommodated in the present building.

SCIENCE DIVISION.

The Division of Science includes the departments of Bacteriology, Botany and Genetics, Chemistry, Mathematics and Physics, Zoology, Geology and Entomology, all giving instruction prescribed in one or more of the courses of study offered by the College.

It goes without saying that Chemistry, Bacteriology and Botany are fundamental in all training in agriculture; that Chemistry and Bacteriology are equally basal in a home economic course; as is Zoology to all work in stock and human nutrition. Mechanical Engineering is based on Mathematics and Physics and the courses of these departments are all prescribed in the Mechanical Engineering course.

The principles of Geology and Physics are necessary in an understanding of tilth, drainage and water supply and Entomology gives that knowledge of insect pests without which no one can be successful with crops or animals.

The instruction of the college therefore centers about these fundamental courses and many departments about the more advanced courses in the division of science. On the proper maintenance of this division in personnel, equipment, class and laboratory facilities, rests the success of all the other courses of instruction of the college.

As is indicated below under the several departmental statements, the members of the science staff, in addition to their teaching work, are carrying on investigations on problems which are of distinct practical importance to the agriculture of the state. Some of this is carried on in association with the Experiment station. In Mathematics, Botany, Chemistry and Bacteriology, it is conducted independently and is not allowed for in the schedule of work of those concerned.

BACTERIOLOGY.

Purpose:—The purpose of the courses in bacteriology is to make available to all students, and especially to those specializing in Agronomy, Dairying, General Agriculture and Home Economics, a knowledge of the significance of bacteria in these fields. The elementary courses are distinctly practical and theory is reduced to the necessary minimum. In the more advanced courses work is more technical and is applied to special phases of dairy work and agronomy.

The teaching and laboratory work are done by the head of the department and one instructor who devote all their time to instruction and preparation. The investigational work of the head of the department is carried on out-of-hours by making the day's work long.

Investigation:—The investigational work of the department includes both field and laboratory research. Since 1916 a series of experiments have been conducted on a three-acre field to determine the significance of bacteria in crop production and soil building. The laboratory investigation is largely water analysis and the testing of milk for bacteria content.

Equipment:—The present equipment, entirely of laboratory supplies and instruments for teaching and for culture work, is valued at $7,889.64. The annual cost of maintenance, excluding salaries, is $1,000.

Needs:—The department needs more room for teaching and investigational work, a projection lantern for microscopical slides, and illustrative charts to make the teaching most telling and effective. The library resources on bacteriological publications are more than limited and should be developed with the times, for progress in the science and in its applications is so rapid that not to have access to the latest and best information is to be inefficient.

Another assistant for instruction and investigational work would materially increase the work that can be accomplished by the department, and better secretarial and stenographic assistance is seriously needed.

BOTANY AND GENETICS.

The department of Botany and Genetics offers instruction in these subjects, maintains an Experimental Botanical Garden for demonstration purposes and to supply material for class work, and carries on investigational work.

The elementary course in Botany is prescribed since a knowledge of plants and of the principles of plant growth is necessary for all students in agriculture. The more advanced courses in plant diseases, plant classification and plant breeding are more particularly for those who are interested in preparing for specialized work in the horticultural field.

The course in Genetics presents the principles of breeding and inheritance so far as known and lays a ground work for application in stock and plant development. So much of our breeding work in the past has been casual and unscientific that in these days when errors are so costly, a knowledge of genetics is necessary to the skilled and progressive farmer. Genetics also contributes a very valuable factor to the education of any man or woman who is not interested in the subject in a practical way.

The teaching and laboratory work is done by the head of the department at full time, one instructor on half time and with one graduate student laboratory assistant.

Investigation:—The department is carrying on extensive investigations on squash breeding, is studying the laws of growth in certain crop plants and, in co-operation with the department of Chemistry, is investigating the oil inheritance in soy beans, now coming into great favor in the dairy sections of the state as a forage plant. This work involves the carrying on through the summer months of the Botanical Garden, which is also used to develop materials for class use and for demonstration purposes including several hundred species of the more important economic herbaceous plants.

Equipment:—The laboratory equipment, a small departmental library and an herbarium of about 1,000 sheets from the departmental equipment valued at $5,000. The cost of maintenance exclusive of salaries, is $1,200 annually, one-half of which is expended on maintaining the Garden.

Needs:—The departmental needs, like those of the other science departments, are mainly more room and a better teaching equipment. The latter is contingent upon the former and can best be met by a new Science building that will harbor and centralize the several departments. Greenhouse room for growth of plant material for class use, especially in the winter months, is much needed at once, for many of the principles of plant growth cannot be illustrated to advantage by the seasonal plants available in the closed season months.

With any increase in student enrollment, at least the full time of two men will be needed adequately to meet the demands for real, personal teaching.

DEPARTMENT OF CHEMISTRY.

The purpose of the courses in chemistry is to give the necessary foundation work for all students and such technical courses of a more advanced nature as are needed by students in the Home Economics Department and in certain of the phases of agricultural instruction. The department also gives a brief course adapted to the needs of students in the School of Agriculture. In addition it is carrying on investigation in several problems in agricultural chemistry.

The teaching work is done by two men and a laboratory assistant, all devoting all their time to the work, except that the head of the department devotes 10% of his time to administrative duties and 10% to research.

Investigation:—The department is carrying on research work along the following lines:

1. Selection for high oil content in soy beans. In association with the department of Botany.
2. Methods of food preservation.
3. Correlations between the physical and chemical characteristics of whole and watered milk.

Equipment:—The equipment, restricted to that necessary for carrying on the courses listed, is valued at about $7,000 including supplies on hand. The annual budget of the department exclusive of instruction, is $1,000.

Needs:—Since the loss of the chemistry building by fire, the department has been sorely tried to fit accommodations to demands. Owing to the large and necessarily increasing enrollment, and to the fact that instruction in chemistry must be largely in the laboratory, the laboratory facilities are so crowded as to be inefficient. Larger laboratories would mean fewer sections, and a saving of time on the part of the staff with equally efficient instruction. A non-incidental part of chemistry teaching is getting equipment ready for demonstration and laboratory work, a necessary expenditure of time not allowed for in any statistics of student enrollment and class hours.

The imperative needs are adequate housing and an increase in equipment for both elementary and advanced courses that will permit the department to respond adequately to the needs of the other college departments.

More extended courses are needed in Analytical and Physiological Chemistry, in the chemistry of nutrition, in soil and daily chemistry, in physical chemistry, and in the chemistry of foods and textiles. This may seem like an elaborate outline, but when one considers the importance of nutrition in the daily work of the agricultural worker, the home economics teacher and the welfare worker, and the part that chemistry is called on to give in soil and dairy work, the offerings sketched are really a minimum and restrict the development of the department to necessities involved in the present courses of instruction.

MATHEMATICS AND PHYSICS.

The courses in Mathematics and Physics are prescribed in the courses in Mechanical Engineering and in Science. A special course is given for women in Household Physics. The courses in Mathematics range from Advanced Algebra to Calculus, and are the basis of work in Mechanical Engineering.

The teaching is done by the head of the department, who devotes four-fifths of his time to teaching, and by an assistant on half time. In addition to the work of the department, certain courses are also given in Mechanical Engineering.

Investigation:—Investigational work is a minor feature. Studies have recently been made in the correlation between egg production and the physical characteristics of the layer, and in the effect of insulation on cooling milk. Other investigations have been on problems of value in the work in Mechanical Engineering.

Equipment:—The equipment of a value of $2,000 is entirely limited to teaching apparatus and to field instruments. In Physics it is wholly inadequate. The expense of maintenance, other than instruction, is about $500 a year.

Needs:—The needs of the department are better equipment in physics and better laboratory and class room facilities, which could best be supplied in a Science building in which the lecture rooms could be used in common with other departments.

DEPARTMENT OF ZOOLOGY, ENTOMOLOGY AND GEOLOGY.

The course in General Zoology is required in all courses except that in Mechanical Engineering. The course in Nutrition and Hygiene is prescribed in the Home Economics course, as is Geology in the Science course and is taught so as to be distinctly practical in nature. This is especially true of the courses in Entomology, in which students may do advanced work, and in the course in Nutrition and Hygiene, which aims to give the students an understanding of and a respect for their bodies. The large number of boys electing this course is an evidence of its strength and usefulness.

The teaching is done by the head of the department devoting three-fourths of his time to teaching, and an instructor devoting all his time to the work.

The methods of teaching are to a degree determined by the restrictions of space. Many things have to be shown to students that should be presented in such a way as to give training in observing and thinking.

Investigations:—The head of the Department devotes about one-fourth of his time to investigational work in the Experiment Station. This is devoted to a study of animal parasites. At present the most important problem under study is the control of the stomach worm in sheep, for which an experimental flock of about thirty-five sheep is maintained. Within the past two years studies have been made and the results published on control measures for cattle lice, hen lice and roost mites, and on the effect of humidity, cooling and carbon dioxide on the embryo chick during incubation.

Equipment:—The value of equipment of the department is $5,329.34 and the annual cost of upkeep, exclusive of salaries, is less than one thousand dollars a year. The department is fairly well equipped with laboratory apparatus, but not well equipped for teaching entomology and zoology through the study of problems, now recognized as the best method of teaching.

Needs:—The greatest need of the department is more laboratory room, where students may study living material. Office and storage room is also needed. An assistant is needed in the large laboratory course, and if investigation is to be carried on in a satisfactory manner, an investigator who can devote all his time to the practical, pressing problems is much needed.

More stenographic and office assistance would increase the efficiency of the work by many percent. It is especially important that more help be given in filing the current publications which are so necessary in the four phases of the department's activities. This material is important for both students and instructors and not to be able to keep it in good reference form weakens the efficiency of the work in the Department.

Since the recent publication of studies on parasite control the demands on the Department for identifying specimens and recommending control measures are very numerous. More stenographic help is urgently needed.

The room facilities can be met soon, it is hoped, in an adequately constructed science building. The additions to personnel and equipment involve increased maintenance appropriations.

STUDENT ACCOMMODATIONS AND ACTIVITIES.

Accommodations:—The accommodations required in a college are of two types—those needed for physical comfort and well being of the students and unmarried members of the staff and working force, and those designed to contribute to the social side of life. College spirit, that indefinable something that gives tone and quality to an institution, and which makes the average graduate a supporter of his Alma Mater through life, depends on satisfying both the physical and social needs of the students during their years of undergraduate life.

In the first group may be listed the dormitories, the dining hall, the gymnasium (Armory) and the athletic fields. The dormitories are today housing double the number for which they were planned, with four boys in a suite meant for two. This is a serious handicap to the students, for it means confusion, interruption to study, which works against concentration and real training, and a weakening of college spirit. Any increase in men students means improvised quarters until a new dormitory can be furnished—a condition that has been tested out and found more than wanting in the last year by the necessity of housing the women in improvised and inadequate quarters in Whitney Hall.

The greatest need of the college on the physical side is an adequate women's building that shall be a center for the women's work and contain dormitory, class rooms, laboratory and office facilities, and around which may center the women's college life.

The new dining hall, that will accommodate 350 at a sitting, will be ready for the next college year. With increased accommodations for serving, storing and cooking, it should be possible adequately to meet the demands for eating facilities—always the most difficult phase of institutional accommodations.

The facilities for indoor exercise are excellent, and the Armory is used in the winter at all hours. The finishing of the swimming pool would add materially to the exercise and comfort facilities of the college in the closed season. The present athletic field accommodates the organized teams, except for track facilities, which should be provided. The field also seriously needs draining. There is a great need for tennis courts, play grounds for improvised ball teams, and a hockey field for both men and women, for the physical well-being of the student body depends not on systematic exercise for the few who become members of organized teams, but for everyone, and on furnishing such facilities that each person may take the type of exercise that gives him the most physical and mental satisfaction.

Activities:—The student activities, apart from athletics, are many, as is characteristic of all colleges. These include associations that have contact with the public like the college paper, the Press Club and the Glee Club, fraternities which are organized for the mental and spiritual improvement of the members, clubs for special purposes, like the Agricultural Club, the Debating Society, the Dramatic Club and the Y. M. C. A. These and other associations have no fixed homes, and hence miss their full value. When an organization has no definite center and its affairs must be carried in the mind of its officers, it is likely to lose its value as an association for training in co-operation, and hence be of lesser significance than is warranted.

A College Union to be the home of the undergraduate student activities and to be the center of student life would add materially to the welfare of the college. Such a building should evidently come from private funds, and might well be erected by alumni and friends as a War Memorial. A College Union has been tried in many institutions and in every case has proved a vital and really necessary part of the equipment of the college.

With such a diversity of interests as is found in the college, any contribution to unification is earnestly to be desired. Scattered efforts, often duplicative, tend away from a real centralization and purposeful organization of the activities which are a normal part of the college life.

The several fraternities have meeting places in the college buildings, in rooms not available as living quarters. One of the older fraternities has recently purchased a piece of land on which it is hoped ultimately to build a fraternity house that will offer to the members the full benefits of fraternity life, and which will be the hospitable rendezvous of returning graduates.

Fraternity organization is so significant today, and its possibilities for good and its dangers are so many that the question arises as to what the policy of the college should be in reference to fraternities. Should they be limited in number? Should they be encouraged to build houses as their finances warrant that would relieve the dormitory pressure, and under what conditions?

The Debating Society and Dramatic Club are primarily for the benefit of the members. The Agricultural Club not only holds frequent meetings at which members of the staff and speakers from without present to the members significant matters not involved in regular courses, but holds each year a very successful midwinter fair that proves of great educational value.

The Y. M. C. A. is the only student religious association of the college, and it is both active and effective. The students are interested in improving the opportunities for religious and social service work among the students. Because of their enthusiasm and sincere support of the work, the Y. M. C. A. has been allotted a room in the Armory and has started a private campaign for funds to furnish the room. They are planning furnishings that would be appropriate in a special room in a students' building, should that ever be available.

The development of real college spirit and of the right attitude toward many of the problems of life depends to a large degree on the proper development of the informal side of student life. Real co-operation, so vital in all things today, can best be made effective by being tried out in the formative years of a person's life. How to live together, work together, and play together; how to compromise individual opinions for the welfare of the whole and how to combine efforts in a common cause, are elements of training for life that should be encouraged in every way. At present the facilities for social life here tend toward individualism or group struggle for supremacy. An attitude of mind on the part of leaders that will encourage a general tendency among the students to carry responsibilities and contribute their part to the student life is an educational force of great value that should be fostered in any institution. This is a problem in which alumni, friends, faculty and students must co-operate in solving. The right development of student activities is an essential element in upbuilding the Institution as a whole, as important as courses of study or the equipment, for it deals with matters of the spirit.

Other Needs:—One of the greatest needs of the college is a small fund (at least $1,000 annually) that could be used to bring to the Institution significant speakers to address College Assembly on topics of the day and problems of general interest. In other institutions of similar scope such a plan has been tried and has been found very beneficial. It is worth a great deal to have heard and seen some of the men and women who are leading public thought. Students should have brought to their attention matters outside the curriculum, in which thinking men and women are interested. Specialization and breadth of interest should be handmaids, and the more a student specializes the more chance he should have to keep in touch with matters of the world. It would help the college to be better known to men and women of note, and it would be a great contribution to the students' training to be able to hear from time to time speakers of reputation and significance.

At the present time there are no funds available for any extras of such a nature or for conducting any social affairs by the college for the benefit of the students. Such a fund as is indicated would, it is believed, be more than a good investment, though the results could not be measured directly. It would be worth something to have the students feel that their college was able to command the services of busy men and women of affairs.

REPORTS OF PILGRIMAGE COMMITTEES.

REPORT OF THE "PILGRIMAGE" EXECUTIVE COMMITTEE.

Connecticut is mainly a manufacturing state. By far the greater portion of its millions are engaged in industrial and commercial pursuits. This is the greater reason why the food-providing resources of the state need all possible development. As it is, the agricultural acres of Connecticut are far short of their possibilities of either extensive or intensive production. The economic welfare of our industries and people depends on a better agriculture.

To obviate this shortage, to make agriculture in this state count to the full extent of its possibilities, stands the Connecticut Agricultural College.. It stands to serve ideally as well as practically. Chief among its aims, as they are officially expressed, is to inspire agricultural leadership. It is here not merely to teach the elements of successful farming, not only to show how the thing may be done; its higher mission is to establish in the minds of all the people of the state a true conception of the nobility and the exalted province of agriculture, and to call to its leadership, quality and influence, whose force all the state shall feel.

This is an eminently high purpose, and demands for its fulfillment the state's best support in intellect and wealth. The ground for the demand is fundamental. Such an institution, adequately maintained, will feed not alone the bodies of Connecticut's people, but their intellects and their character. Hardly any of the state's ancient and esteemed institutions of learning has better opportunities, with such support, to contribute to those forces which may make this state supremely great. But unfortunately it is obvious that, of all such Connecticut institutions this, almost the only one for whose support the state is solely responsible, is the least adequately supported. Its opportunities are marvelous. Compared with them, its provided facilities are pitiful.

The great War awakened many of the people of Connecticut who never realized before their state's undeveloped agricultural possibilities. For the time of its continuance it slackened the pace of the Connecticut Agricultural College. In the return to normal state life, the management of the college found itself facing tremendously increased responsibilities, with resources rather diminished than increased. To avail itself of certain Federal funds, the institution had by legislative enactment assumed certain definite obligations, such as the teaching of mechanical engineering, the maintenance of an extension service and the training of teachers in agriculture and home economics. The demands on it were growing by bounds; its facilities were almost standing still.

But there had come into the management men and women of vision and faith. One of the forms their faith took was the belief that if the people of Connecticut, or at least some of their representatives leaders, could see the case as they saw it, the state would come to the rescue. And the practical result of that belief was the call for the "Pilgrimage" of May 26, 1920, whose concrete results appear in the conclusion of these and the accompanying pages.

The "Pilgrimage" organization, which was begun to study the needs of the college, resulted in the appointment of committees whose inspection of the institution and subsequent meetings constitute a survey of rare value to the state. Whatever action is taken in regard to these reports, the Agricultural College has a program, which may be modified when necessary, but so well planned that as growth and changes come, as they will, improvements and needs can be treated in the order of their necessity.

The reports of the various committees represent the best thought and judgment of men and women eminently fitted by training and experience to perform their tasks. The sum of all their activities gives a broad outlook for years to come, together with many details. To those who have the interests of the college at heart and who want information in regard to its growth, present value and future possibilities, we suggest the reading of the entire report of the committees. Legislators whose work will include appropriations for maintenance and growth of the institution may through these findings be able more easily to "image the whole, then execute the parts." The "summary of reports" prepared for the Executive Committee is approved, and might well be presented as a summary of the reports by that committee but we hope those who will want information about the Connecticut Agricultural College will go to Storrs and inspect for themselves, then read the full reports of the committees as well as their recommendations.

To the summary of the reports of committees we would add the following, based on observations of agricultural colleges not confined to the "Pilgrimage," but covering the last fifteen years. Our conception of the purpose of an agricultural college is to develop agriculture in the state, and how to do that effectively, and at least expense, is the problem. During the war one farm bureau man would cover a whole county, making suggestions to farmers about seeds, fertilizers, live stock, orchards, advising about crops, buying and selling, and generally helping those already engaged in agriculture. Every agent was the direct means of increasing farm products far in excess of anything he could have raised by his own labor. Extension workers organized Boys' and Girls' clubs, and research men experimented with blights, insects, animal and poultry diseases, that valuable information might be sent out through the state. Each woman as a demonstrator taught better ways of cooking, canning, dressmaking, home making and social service, accomplishing perhaps twenty times what she could in a home.

The call has been for the well educated man and woman, knowing everything possible about rural life, and our state college has met this demand to some extent. It can and should do more. The higher the standard, the more students will be drawn to the institutions, and the more will hold out through the four year course. It is human nature to want the best, and to be willing to work and sacrifice to get it.

Graduates from Storrs will need far more than the rudiments and theory of agriculture. Physics, chemistry, bacteriology and biology, as applied to the farm, they must have, but to answer questions, hold their own and command the respect and confidence of the people, no regular college course in science contains more information than they should have. English, economic history, civics and economics are also imperative needs. Call them cultural subjects if you will. The farmer will send his children to the cities for culture if it is not obtainable at home. The agricultural college graduate, director or leader has lacked general education in the past. A strong cultural academic training added to technical agriculture will draw healthy, ambitious, right minded young men and women to the profession of agricultural practice and leadership.

This brings us to the question, how can we obtain the highest grade of preparation and service from graduates? Answer: Through a president and faculty qualified and inspired to develop such a product, and through proper equipment and adequate maintenance.

With the co-operation of the trustees and faculty the President of Connecticut Agricultural College during the last ten years has raised the standard of the institution year by year until no prophet is needed to show that advancement will continue as long as he has the strength and the means to work with. During that time many changes in the faculty have occurred. Teachers and professors are idealists, who think less of money than of their work until mechanical means and equipment are exhausted, or the pinch of a small income drives them from their chosen work. Most colleges have made substantial advances in salaries, but the Connecticut Agricultural College cannot do that without authority and appropriations from the state. Five hundred dollars flat raise for all would be a small amount. Perhaps the next legislature will do better than that, but we speak of it, as a minimum suggestion. Professors and officers cannot inspire the students to their best efforts while under the depressing influence of a salary whose purchasing power is less than half what it was a few years ago.

The quality of product in the form of graduates is also influenced by the appearance and well being of the farm and stock, the condition of buildings, the efficiency of the library, the adaptability and equipment of laboratories and classrooms. If it is impossible to attain the ideal at once, there are some needs more pressing than others which should be cared for first. More than any other one thing, a general laboratory and recitation building chiefly devoted to science is needed. Such a building, with a small auditorium and laboratories for physics, chemistry, biology, and bacteriology, possibly with classrooms for language, history, and civics, will add more real strength to the college than any other one project today. The need is so urgent that the president and his associates should be requested to present the details to the proper authorities at an early date.

Of the appropriations by the state for the college in the forty-year period from 1881 to 1920, 75 per cent. have been for dormitories, faculty cottages, water, heat, light and such things, and only 25 per cent. for buildings for instruction. Excluding the armory, the amount appropriated for the purchase of land, the erection of buildings used for academic, scientific and technical instruction and for farm barns and buildings, amounts to but $279,343. This is less than a city of second-class population (New Britain) is expending this year for a school building.

But while buildings for instruction, and particularly a science hall, constitutes the most important building need of the institution, the immediate need for a dormitory for young men should not be overlooked. The registration for 1919-20 shows 292 male students. Of these 250 were quartered in two dormitories, originally designed to accommodate 66 students each. This overcrowded condition of living quarters is not conducive to good deportment or serious scholarship. Anther dormitory is needed to accommodate the male students now enrolled. And even when that is provided it will not be wise to attract or receive additional students until further buildings are provided.

It should be made clear to the public that the Connecticut Agricultural College is more than a college. Extension work in home economics, the Farm Bureau and like interests center there. An experimental station, under government experts, is in constant service on the grounds. The poultry experiments and egg-laying contests are national in their character and interest. Farming, dairying, fruit growing and the vital farm activities are in operation on a large scale. Many departments are calling for help to maintain standards or improve conditions, but most urgent of all the needs is the support of the teaching staff and the erection of a science building. This will provide in classrooms and laboratories, connected with the farm a course of training in agriculture containing such a substantial body of combined practical, academic and cultural thought as becomes a state institution. Without it we may apologize and explain, but with it we shall be proud of our agricultural college.

PILGRIMAGE EXECUTIVE COMMITTEE:

C. J. Abell, Lebanon.
Mrs. H. M. Bernard, Rocky Hill.
Arthur E. Powers, Manchester.
Frank S. Hitchcock, New London.
Nathan D. Prince, Hartford.
Everett G. Hill, Hartford, Chairman.

REPORT OF COMMITTEE ON ADMINISTRATION AND LIBRARY.

Members of the Committee:

H. B. Mallory, Chairman, Danbury.
G. S. Godard, Hartford.
F. O. Vinton, Eagleville.
J. M. Merrow, Hartford.
Mayro Keeney, Somerville.
E. J. Hoadley, Hartford.
W. B. Bassett, Hartford.

Meeting called to order by Chairman Mallory.

Mr. Godard elected Clerk of Committee.

Members of Committee present: Chairman Mallory, President Beach, Messrs. Vinton and Godard. Regrets were received from Mr. Hoadley.

President Beach called attention to the plant of the College, the facilities offered by it, and the conditions which obtained there, emphasizing the fire hazard and the inadequate filter beds. He also called attention to the report of the Committee on Student Accommodations and Activities, made to the Trustees on July 5, 1920. From these it appeared that the college represents an investment of about $2,000,000, has about 1,500 acres of land, dining hall accommodations for 400, and suitable dormitory accommodations for only 132 boys and no accommodations for the girls, the girls' building having burned last year. It also appeared that although 300 boys were admitted, 50 other boys had to be turned away, that the State Board of Education looked to the Connecticut Agricultural College to teach Home Economics, and that the 69 girls of last year were forced to have their cooking classes in the Poultry Building.

Attention was also called to the increased cost of living which vitally affected all departments of the college and everyone connected with them, and that the filter beds were being worked 50% beyond their capacity.

After inquiry and discussion the following resolutions were unanimously adopted:

1. "That it is the sense of this Committee that a suitable building to accommodate from 100 to 125 girls should be erected at the earliest time practical."

2. "That an additional dormitory conveniently located to accommodate about 100 boys should be erected as soon as practical."

3. "Owing to the decreased purchasing power of the dollar this committee recommends an increased appropriation adequate to run the college in a manner necessary properly to perform its necessary functions and insure a competent and contented corps of instructors and provide for necessary improvements."

4. "That a suitable survey by the New England Board of Fire Underwriters be made and its recommendations considered for the safety of the occupants and the protection of the property."

5. "That the necessary additional filter units be provided for."

6. "That facilities for handling coal be investigated and improved."

7. "That while a suitable library and administration building and cottages for faculty and employees are much needed for the proper work of the college, the Women's Building and Boys' Dormitory should be immediately provided."

The clerk having been requested to transmit to each member of the committee for his approval and forwarding to E. G. Hill, Chairman of the Executive Committee, Hartford, the minutes, the meeting adjourned, subject to the call of the Chairman.

Respectfully submitted,

GEORGE S. GODARD,
Clerk of Committee.

REPORT OF COMMITTEE ON AGRONOMY AND AGRICULTURAL ENGINEERING.

To the Board of Trustees:

The committee submits this as a preliminary report, covering the more important results of its investigation. We plan to spend more time on the problems assigned and report more fully later.

1. **Experimental Work.** We recommend that funds be made available for active investigation of the following problems:

a. Pasture improvement.

b. Crop rotations from the standpoint of best use of labor.

c. Supplementing manure with fertilizers.

d. Soil survey of the state.

e. The adaptation of farm machinery to New England conditions. Most of the machines on the market are not well suited to our farms. A careful study of this problem will net large results for Connecticut farmers.

2. **Increase in Facilities.** We recommend:—

a. Land. That all experiments be tried out on larger plots before final results are made available. At present the field experiments are restricted to small plots by reason of lack of space. Farmers want to see this done on a larger scale. Some arrangement should be made to provide for this.

b. Buildings and Equipment. At present the teaching of Soils and Field Crops is seriously handicapped for lack of space, being housed in two rooms in the Dairy Building. More than half of the Farm Machinery Laboratory has been taken over for offices. Instruction in these subjects is vital to all phases of Agriculture.

We recommend therefore the early erection of the Agronomy Building. Plans are already made for a simple building to cost about $125,000.

Signed,

W. C. WOOD,	L. F. HARVEY,
LUCIEN SANDERSON,	F. D. JORDAN,
S. F. WILLARD,	H. J. BROCKETT,
D. J. MINOR,	F. B. GRIFFIN.

REPORT OF THE COMMITTEE ON ANIMAL HUSBANDRY AND FARM.

Members of the Committee:

- Samuel Russell, Jr., Middletown, Chairman.
- Henry Dorrance, Plainfield.
- M. E. Pierpont, Waterbury.
- Edwin Cruttenden, Crescent Beach.
- Charles L. Gold, West Cornwall.
- Frank Spiekerman, Greenwich.
- Ralph J. Averill, Washington Depot.

In making the following report it has been the object of the "Pilgrimage Sub-Committee on Animal Husbandry and Farm" to consider only the most pressing needs of the Connecticut Agricultural College, both for the present as well as for the future.

Our investigations show the scope of work for the department of Animal Husbandry to be almost without limit.

We say this advisedly knowing, as the following brief statistics will show, that live-stock is behind all agricultural projects whether they be the production of grain, tobacco, potatoes, fruit or any other farm crop. Crops need fertility and it is our belief that through no other source can fertility so well be obtained as through more animals and more manure.

The appalling decrease in the number of animals in Connecticut during the past seventy-five years accounts, in part at least, for the equally appalling decrease in other food supplies compared to the increase in population.

The following table shows figures obtained from the state agricultural census of 1845 and from the census of 1915, the latter being approximately correct for 1920.

Census of 1845.

Counties	Cattle	Pigs	Sheep
Hartford	31,595	26,067	37,443
New Haven	23,728	13,217	16,682
New London	25,243	18,001	51,032
Fairfield	29,271	20,926	20,429
Windham	20,672	17,515	34,254
Litchfield	45,478	27,953	88,741
Middlesex	15,140	7,086	14,918
Tolland	15,098	8,225	26,065
	206,225	138,990	298,574
Total livestock of state, 1845			643,789

Total cattle in 1915	119,000
Total pigs in 1915	59,000
Total sheep in 1915	18,000
Total livestock of state, 1915	196,000

These tables show a decrease in 75 years of 447,789 animals.

Statistics show that the people of Connecticut are now spending annually $150,000,000.00 for slaughtered Western meat. Pork products alone which we buy from the West amount to 300,500,000 pounds a year, and about 12,000 car loads of hogs on the hoof are also shipped in. We do not include these hogs in the above estimate of slaughtered meat costs. We urge the college to extend the work of its Animal Husbandry Department that it may at least partly supply this aching void.

There is, here in our state, something radically wrong as there is always at hand a ready market for, and an annual consumption of ONE HUNDRED AND FIFTY MILLION DOLLARS worth of meat, all of which is supplied from outside.

These goods, or meats, can be produced here at an economic profit, being protected by the present freight rates which unquestionably are a protective tariff if there ever was one. Furthermore with Connecticut holding the record of the United States for corn production per acre and being close to the top on other grain records, we feel that many more cattle, sheep and hogs could be profitably grown, finished and sold.

Buyers from Europe and South America have begun to look for our best stock to replace their devastated and diminished herds. These buyers come to us through our two great ports, New York and Boston. Our State and College should stand with and for the farmers (as well as our bankers) in enabling them to supply this market.

We feel that it is for our College, backed by the state, to show through its Department of Animal Husbandry how nearly Connecticut can be brought back to, or even beyond its original self-supporting condition.

There are many thousands of acres which years ago were tilled, but now are idle. There were many more thousands of acres pastured by the 87,000 cattle and the 280,000 sheep, both of which are now lost to Connecticut agriculture. There was no meat and there was no grain brought into the state then. Now over three hundred million dollars' worth of meat and grain has to be bought from outside each year.

For the redemption of our agricultural standing we present this report with its recommendations which ask for appropriations representing less than 1/300th of one percent. of the amount now being lost by Connecticut.

Connecticut produces less food per capita than ever before in her history. The time has come for our College to make a collossal contribution toward the redemption of the economic standing once held by the state.

We recommend that the College support the Department of Animal Husbandry, to its uttermost, that this goal may be attained, through the purchase of animals and the construction of buildings such as will be comprehensively illustrative and contribute the most to our weakened position.

When we had one-third the present population we had three times as many animals. Now there is so great a decrease that to bring them up to numerical and market requirements we should multiply the present number of cattle, sheep and pigs (196,000) by twelve which would make 2,352,000 or 2,156,000 more than there are now.

In recommending the purchase of the following animals we have carefully considered the number of animals for each breed, the various breeds best suited to the college uses, and those which will be most beneficially illustrative for the betterment of Connecticut agriculture.

We have carefully gone over and inspected the barns and other farm buildings and in so doing we have appreciated the lack of apparent co-ordination of thought regarding the economic grouping of buildings, convenience of same, time saving arrangements, as regards labor in or about the buildings, time and distance for students to cover in the accomplishment of their work, and the general efficiency and effectiveness of the layout of the plant, as well as its impression upon the visiting public.

An institution such as the Connecticut Agricultural College has many lessons to teach and among them, and of no small importance to the agriculturist, is proper planning for the saving of time and labor.

We appreciate why the buildings are as they are, why distances are so inadvisedly great and why there has been no formulated plan for convenient grouping.

The old buildings, especially barns, are being used to the best possible advantage, which is saying little for them, when we consider that they are where various former owners put them and especially as they were built for purposes other than that for which they are now necessarily used. We will later make recommendations as to their ultimate end.

Manufacturers for economic reasons either sell or abandon their old plants that they may locate on new ground and group their buildings in such a way as to save time, labor and money.

With a million dollar plant it is time for the College to consider such conditions.

The investment is too great to consider abandonment but it is certainly sufficient to warrant immediate plans toward perfection.

No more state money than is required for upkeep and temporary changes should be expended on buildings poorly adapted to needs.

Future appropriations should go toward a well organized plan for constructional grouping which it may take some years to complete, but such planning should be done at once and before anything new is built.

Percherons:—The College now owns one good Percheron stallion and six registered mares. We recommend the sale of two or three mares and the buying of two better mares to take their places. We suggest that such mares as may be purchased be bought in foal to sires of note. We advise the sale of the younger stallion.

Belgians:—There is now one excellent Belgian mare in the College barns. At least four more Belgian mares of equal merit should be bought, as well as a first class sire.

Brood Mares:—Twelve registered brood mares would not be too many for the College to own as they and their offspring could do much of the farm work now being done by the 25 to 30 farm horses.

Farm Horses:—Some of the farm horses are of a very low order and should be immediately replaced by horses of a good general farm type. We would prefer the purchasing of mares in order that they may be bred if so desired, thereby demonstrating the grading up through a registered sire.

Quality of Animals:—We object to the College having such horses as referred to above, as we consider them detrimental to the reputation of the College. Only good, straight, sound animals, suited to the purpose for which they are used, should be kept. This statement also applies to all other breeds of animals.

Herefords:—Most of the Herefords are of very satisfactory quality but among this little herd are two or three that we advise selling, and devoting the proceeds from them to the purchase of others of better quality.

Shorthorns:—Connecticut farmers are becoming interested in dual purpose animals. We therefore recommend that five high-class registered Shorthorn heifers or cows of the milk type be bought. The College now owns a very good bull.

Sheep:—The sheep department is in a good, healthy condition so far as it goes, but we feel that it should go much farther. Now there is only a flock of Shropshires. We recommend the purchase of six good registered Hampshire ewes and a ram, and a like number of Rambouillets, also registered.

This recommendation is in order that the renewed interest in sheep husbandry may be advanced. We believe that these two breeds will do more in this way than any others which might be immediately added, but we hope that at least two more breeds may be added each year until many of the best varieties are represented at the College.

The students should be enabled to study the wool breeds as well as the mutton type.

Swine:—Berkshires, of which there is now a good herd, are most satisfactory, and the keeping and breeding of this variety of pigs is thoroughly approved by the committee. Our recommendation is that another breed should be kept, and we therefore advise the purchase of three Duroc Jersey sows or gilts and a boar. These pigs should be good enough to warrant an expenditure of about $1,000 for four head.

BUILDINGS.

Shorthorn Barn:—The old cattle barn adjacent to the new piggery, we think, should have some slight alterations made in it to accommodate the Shorthorns, but at a minimum cost as this barn is neither suitable in construction or location as a Shorthorn barn. Such changes as are made should be considered as only temporary.

Hereford Barn:—The barn on the opposite side of the road where the beef cattle are now stabled is not a beef cattle barn and the sooner it is abandoned for this purpose the better. As it is in conjunction with the sheep barn we recommend that it be converted into such shape as to be temporarily suitable to house the proposed Rambouillet and Hampshire flocks. The present sheep barns are satisfactory and it would seem wise to keep them until such time as it seems best to build a new and model barn. We advise as small an expenditure on this old barn as possible for reasons appearing later.

Grouping Barns and Other Buildings:—The dairy barn and horse barn are more conveniently located than others and they are fortunately good buildings, too. Therefore, it would seem wise to begin to lay plans for other necessary buildings with regard to their relation to these.

Tool Shed and Shops:—We advise the construction of a Hereford or beef cattle barn, a Shorthorn barn and sheep barn, all of which should be located in a general way between the dairy barn and the horse barn. There is immediate and imperative need of a farm tool shed and in making recommendations for this shed we would say that we want to see a real one; no temporary affair. In conjunction with this shed there should be a good sized room in which to work on farm tools, tractors, automobiles, etc. There should also be in the same group or under the same roof, a paint shop, a carpenter shop, and an up-to-date and well equipped blacksmith shop.

Every student should be able to make a set of whiffletrees, shoe a horse and repair or adjust a gas engine. A blacksmith should be employed the year around. The annual cost of blacksmith work is equalled by the time used, or wasted, by employees going to the shop at South Coventry, five miles away.

Judging Ring:—A judging ring should be built in conjunction with the proposed group of buildings. It might be advisable to make this ring as an addition to the present brick building where the new, or model farm machinery is now housed.

This good brick building seems to have little use at present and in conjunction with a judging ring it would be very useful for the Animal Husbandry Department for lecture rooms, laboratory and the veterinary department.

Such a ring should be at least 150 feet long and 60 feet wide so that there will be room to get a horse into action. Seating capacity should not be included in the above dimensions.

Group Advantages:—With the dairy administration building, the dairy barn, the Shorthorn barn, the Hereford barn, the sheep barn, the wagon and tool sheds and shops, and the horse barn all grouped about and near the Animal Husbandry Building and the judging ring, there can be a reorganization of work for this department and an accomplishment heretofore unknown and impossible.

After the consummation of this grouping plan the old cattle and sheep barns would then be used for hay storage and the housing of young stock, and these two barns to the north should be provided with two to four horse stalls each to accommodate horses which are working at that end of the farm and whose teamsters live in the adjacent houses.

Construction of Buildings:—We advise that the new barns, sheds, blacksmith shop, etc., be built of such materials and on such lines of construction as could be built by the average well-to-do farmer.

Handsome stone, concrete or stucco barns are things of beauty but they are impractical for the average farmer, costing more as an initial investment than the returns on his business will warrant.

Barns such as we have in mind are as illustrative educationally as certain work in a class room. We should build with the intent of showing our agricultural students how and what to build and what they themselves can later build.

New Horse Barn:—A suitable barn for brood mares and foals should be built and the old abandoned piggery where they are now stabled should be turned to another purpose. This old piggery is absolutely unsuited for horses.

Present Hay Barn:—The hay barn, which joins the present stucco horse barn, while unsightly and of inconvenient construction, will probably have to stay where it is. It should have about $1,800 laid out on it for repair work such as new shingles, new bridge, straightening up of foundation, etc., as well as painting. It is in poor condition for a College building.

Housing Problem:—The housing problem for the farm labor is a crying one. Present houses are inadequate and some of them in such poor condition that they do not lend dignity to the property nor do they reflect credit to the state. The unsightly old dwelling on the main highway and in front of the new Dairy Hay Barn should be disposed of at once, the ground graded and all put in first class shape.

Boarding House:—The College farm, like all other farms, where houses are unsatisfactory and inadequate, has trouble in getting and keeping its help. We recommend as a solution to this problem the building of a house suitable for farm hands. It should have 12 single bed rooms, two complete bath rooms and two showers. There should be apartments for a man whose wife would act as housekeeper. Such apartments should have a complete toilet arrangement of their own. Below there should be a large lounging or club room besides the necessary kitchen, dining room, etc. No such building should be erected or planned by the average architect, as they usually make failures of such problems.

Here is where it would easily be possible to use the old stone piggery for a boarding house, a club room, kitchen, etc. The good slate roof could be raised and sleeping rooms be put in. It is well situated for this purpose and would group in well with the other buildings, many of which would be near where its occupants had their jobs. We have no doubts regarding the usefulness of this now very unsatisfactory old barrack.

Entrance Gate:—At or near the completion of the proposed group of barns there should be erected an entrance or gateway designating the department and at the same time dignifying so important a factor in the scheme of agriculture.

Special Architect:—The designing of such an entrance and the planning and location of the barns and other buildings should be given to an architect specializing in this line of work.

Plan:—We recommend that an outline plan of the whole scheme of buildings, properly located and grouped, be made before the construction of any new work.

Coal and Grain:—There is immediate need of a granary of at least two-car capacity and a coal pocket at the railroad. The need for this is pressing as under present conditions coal and grain is handled at great disadvantage. Much hauling of coal and grain is done throughout the summer months. The farm now has to do this hauling, much to its detriment and inconvenience, to say nothing as to its financial loss. Farm work is naturally regulated by weather, weeds, and crop conditions, and so when a car or two of coal arrives unexpectedly the hay gets wet and the weeds grow.

Trucking:—In other words our State College farm should not be expected to go into the trucking business any more than any other farm does. On the other hand if there is ample storage space at the railroad, the farm then could haul these necessities more at its convenience through the late fall or winter months. Last winter the farm had to re-cart coal a second time on the College property to the extent of more than $1,000 cost. Such a storage place as we recommend would do away with this duplication of work and wastage on farm crops.

Ice:—Neither should the farm be in the ice business, simply because this means trucking, too. The College ice route is nearly five miles long. It takes a farm team and two men off from their farm work some 700 hours at a cost to the farm of nearly $1,000.

Truck:—As a correction to this condition we recommend the purchase of a truck of not over one-ton capacity. We suggest a Reo. This truck should be used for ice delivery, collection of garbage, repairing of roads, of which there is much need, and the handling of light freight. This truck and the work we propose for it should absolutely not come under the Farm Department.

Tractor—The only expensive farm tool which seems advisable is a tractor. We recommend the purchase of a tractor of caterpiller type such as a Cletrac because of its ability to work where others cannot. With the purchase of this tractor we recommend the purchase of all necessary tractor tools, including a "Brush Breaker" plow.

Dairy Animals Under Department of Animal Husbandry:—The selection, care, feeding and breeding of dairy cattle should be under the Department of Animal Husbandry. We consider dairying a farm industry or project and we have no reason for believing it to be anything else and therefore recommend that the dairy barns and dairy cattle be turned over to the Department of Animal Husbandry.

All milk should be delivered by the farm to the Dairy Department at its dairy, at a price not to exceed $0.10 a quart.

Feeding experiments which may be desired by the Dairy Department may be carried on by the Department of Animal Husbandry, but when such experiments create an added expense such expense shall be paid by the Dairy Department.

Dairy Cattle:—Among the dairy cows there are some that are hardly up to the standard which in our judgment should be maintained by the College. We advise the disposal of these animals and when opportunity occurs their replacement by better ones.

Exhibits at Fairs:—We recommend the introduction of a bill into the next session of the General Assembly repealing the now existing law which provides that the Connecticut Agricultural College shall not exhibit its livestock in competition at fairs within the state.

This law is objectionable in that it prevents illustrative competition, and comparison of animals; it eliminates a certain interest which the herdsman might take in caring for and fitting for shows; and the students who have worked with these same animals also lose interest if they cannot see their college stock at least near the top of the line in the judging ring. For the good of the college and education of the public we ask for this repeal.

Pig Specialist:—While this suggestion or request is perhaps not proper to come under the heading of our committee, we nevertheless take the liberty of making it while we have the opportunity.

The Connecticut Swine Growers' Association has an appropriation devoted to the promotion of interest in and for the development and increase of more and better pigs in the State.

We believe it might be possible for the College to co-operate with the Connecticut Swine Growers' Association in securing the services of a competent pig expert whose duty might be to increase the interest in and the number of hogs throughout the state. Such a man should have experience and ability.

Recommendations:—The different subjects listed in this report, are, we think, all of real importance to the College.

We are tabulating and grouping them in the order of their most pressing urgency. All of them are practically of equal necessity to the welfare, progress and efficiency of the College and the Department of Animal Husbandry, but while we appreciate the need of all of these many additions we feel that we are asking or recommending, possibly, more than the state will provide for at once. But we believe that the sooner provision is made for these additions, so much the sooner will the college be enabled to provide an education for our agricultural students more commensurate with the demands of our present agricultural conditions.

Boarding house	$14,000	
Tool shed and shops	7,500	
Coal and grain storage	5,000	
Judging ring	18,000	
Tractor and tools	2,600	
One-ton truck	1,800	
		$48,900
Breeding barn for horses	$7,500	
Shorthorn barn	7,500	
Hereford barn	7,000	
Sheep barn	5,500	
Piggery	3,000	
		30,500
3 Percheron mares	$1,500	
1 Belgian stallion	1,200	
4 Belgian mares	2,000	
5 Farm horses (mares)	1,750	
5 Milking Shorthorn cows	2,500	
1 Holstein bull	1,200	
6 Hampshire ewes	450	
1 Hampshire ram	150	
6 Rambouillet ewes	450	
1 Rambouillet ram	150	
3 Duroc Jersey sows	750	
1 Duroc Jersey boar	250	
		12,350
Repairs and temporary changes on old farm barns (immediate)	$7,000	
		7,000
		$98,750

Respectfully submitted by

THE PILGRIMAGE SUB-COMMITTEE
ON ANIMAL HUSBANDRY.

REPORT OF COMMITTEE ON THE DEPARTMENT OF DAIRY HUSBANDRY.

We beg to report as follows:

Dairy Barn to House Young Stock and Calves, Maternity Pens:—The need for this barn is urgent and the need of a better calf quarters before winter is imperative. We would suggest that temporary quarters for the calves be built and that same be located on west side of manure pit, such an arrangement furnishing protection and the cost of same being within reason. Would suggest that when barn for young stock be built that it should be located east of cow barns, thus providing a protected barn yard between the two buildings and, if possible, so arranged that it can later be turned into a cow barn as the committee feels that the present herd should be doubled.

A Milk Room is also a pressing need and we would recommend that it be built in the center on the west side of the dairy barn.

The Dairy Herd should contain some typical high class stock, quarters for which should be provided as soon as possible, the present quarters being absolutely inadequate.

Creamery:—A complete refrigerating plant for the Creamery is absolutely necessary, the present one having been used about twenty years and giving constant trouble.

A modern ice cream freezer should be added to the present equipment as also should a Majoinnier tester and equipment for a research laboratory to be used for work along lines of market milk and the manufacturing of dairy products. This last would be a necessity if certain lines of work, which it seems advisable to undertake at this time, are to be successfully carried out.

We thoroughly approve of the experimental work being done with contagious abortion and the proposed plans for work in silage feeding investigations and recommend that the work in calf feeding experiments be resumed as soon as possible. together with certain investigations as to the cost of raising heifer calves.

A Research Laboratory will make possible the investigations into the use of fermented milk in controlling intestinal diseases, a great boon to humanity if the investigation proves a success, and also work to determine the heat coagulation of milk.

Staff:—It is very evident that the present staff is inadequate and we would recommend that a graduate assistant in production work and a similar assistant in the manufacturing of dairy products be employed. This should furnish the extra assistance at reasonable cost and at the same time assist those appointed to these positions in becoming specialists along those lines. In order to relieve the Department and give more time for research and investigation work, we would recommend that the care of the dairy herd, as far as the routine work is concerned but without interfering with the investigations which may be in progress, be turned over to the Department of Animal Husbandry.

Your committee would further recommend that in making future plans and in building, an attempt be made to follow as closely as possible lines which would be of value as models to farmers desiring to put up buildings for similar purposes, said buildings to embody all the present-day requirements and at the same time be within the reach of the average farmer's pocketbook.

We believe that the Creamery should, with reasonable limits, be developed as a commercial plant to include the manufacture of the new dairy products. The use of the Creamery in this way will give valuable and practical training to students desiring knowledge of these matters, but in this, as in all matters connected with the Dairy Husbandry Department, an attempt should be earnestly made to make the department as nearly self-supporting as possible by having all the manual work done on a basis and at a cost which would compare favorably with work along similar lines in a commercial dairy manufacturing plant or with a herd on a farm.

Signed by the Committee,

S. McLEAN BUCKINGHAM, Chairman,
ROLLIN S. WOODRUFF,
C. T. DAVIS,
CHARLES G. MORRIS,
ELNATHAN MITCHELL,
C. B. POMEROY,
A. W. LILLIBRIDGE.

REPORT OF COMMITTEE ON STORRS EXPERIMENT STATION.

To the Board of Trustees:

The committee has met and studied the work and needs of Storrs Experiment Station and respectfully submits the following report:

The committee is convinced that a much larger sum than now available is necessary to carry on successfully the valuable work under way. The work on many vital problems in animal diseases and parasites, stock feeding and breeding, crop production and soil fertility is seriously handicapped by lack of funds. There are also many new problems that need solution, funds for which are absolutely lacking.

Your committee is of the opinion that the farmers of the state need this help in order that they may profitably handle their soils and crops, and grow and protect their live stock.

The specific recommendations are as follows:

1. Funds for Experimental Work.

We recommend that the present annual appropriation of $12,500 be increased to $20,000.

2. Buildings and Equipment.

Station barn (very much needed), $10,000.

Signed

JOHN T. McKNIGHT.
A. W. FARNHAM,
W. C. ROBINSON,
J. ARTHUR SHERWOOD.

July 26, 1920.

REPORT OF THE EXTENSION SERVICE COMMITTEE.

To state our conclusion first, the Extension Service Committee is of the opinion that there should be no thought of curtailing this work in any particular; rather that it should be maintained in its present impressive diversity and that every possible way of enlarging its scope should be sought.

A variety of reasons enter into this conclusion. At the outset it should be stated, to save confusion, that while the Federal government bears a large share in financing the work and in a measure indicates its character, and while the Director is actually the representative of the Federal Department of Agriculture, the work is, to all intents and purposes, under the control of the President and Trustees of the Connecticut Agricultural College in that all plans and programs must be approved by the college before they can be put into effect.

Half the supporting funds for the Extension Service are furnished by the Federal Government and it should be borne in mind that in most instances those funds can be supplied only through a Federal Land Grant College. If, therefore, it should be desired to separate some of the work from the college activities, it should be borne in mind that such separation would in many instances lead to a cessation of Federal support and the probable abandonment of activities since it is doubtful if the state would feel that it could afford to finance the work in its entirety.

We believe it to be wholly desirable, from the standpoint of the efficiency of the College that the Extension Service should be conducted therewith and with the College as headquarters for the specialists, as the College is thereby placed more immediately in touch with the Federal Department of Agriculture, a relationship which contributes to the broadening and strengthening of the work at Storrs.

We feel that it would be desirable for the Extension Service to co-operate with the State Board of Education in Boys' and Girls' Club Work, as this work meets at some points that which the State Board of Education does. Since Boys' and Girls' Club Work is conducted under the Smith-Lever act, it must be done by the Extension Service, as the law requires that aid should be given through a Land Grant College in every state.

We believe if the State Board of Agriculture saw fit, it could take over the supervision of the important Market Reporting Service which has been developed in several cities, thus relieving the Extension Service of one detail and permitting it to utilize efforts now spent on that in other directions.

The extension work conducted in what might be called basic farming we regard as highly important. Improvement of stock upon dairy farms, business-like farm management, sheep raising, poultry raising, and the general subject of crop improvement are fundamental for Connecticut agriculture. Connecticut cannot go too far in furnishing the dairy farmer or the general farmer with assistance in increasing the efficiency of his business, since such increase not only is reflected in the prosperity of the whole mass of farmers but in the extension of farming activities and in gross production generally. Increased expenditure in this direction is not only a good investment but an essential investment, as important to the cities as it is to the farmers.

Extension Work is done in other directions, such as among fruit and tobacco growers, and this work is of scarcely less importance, the value of work among dairy and general farmers being emphasized merely because of its fundamental and statewide character.

Extension Schools, amounting to short courses in agriculture, have proven popular in several sections of the state. By these schools the resources of the College, reinforced by the Extension Service, are made mobile and transported wherever they may be of greatest value. No one would attempt to deny that much may be accomplished by such tactics, or that the more frequently such schools are conducted the better it will be.

The importance of women's work and household economics should be emphasized. There are many sections of Connecticut where the standards of living need to be raised. The public health will be promoted thereby and future generations will be better and stronger. Better homes will contribute toward keeping children on the farms. Besides this there is to be considered the very practical help which is immediately given in assisting housewives to meet present conditions, in the buying and making of clothing as well as in the arrangement of their household work.

The growing population of the state, particularly in the towns and cities, demands that Connecticut shall do her level best agriculturally, else the state will be increasingly more and more at the mercy of the West and Middle West for food supplies. By utilizing the Extension Service, curtailing its work in no particular and enlarging it at every opportunity, the state will help itself in this direction.

We are impressed both by the intelligence and thoroughness with which the extension work is planned and carried on—particularly with the careful management of its finances—and we are further impressed by the spirit of co-operation and mutual helpfulness with which the field workers are imbued. In an army it would be regarded as a high standard of morale, and there is no doubt that it is a spirit which contributes largely to the peculiar success which the Extension Service in Connecticut has achieved.

Our conclusions are as stated in the opening of this report.

Signed,

J. M. WHITTLESEY, Chairman.
A. T. MINOR,
C. C. HEMENWAY,
MRS. A. H. BENTON,
MRS. J. M. DEAN,
MRS. JOHN L. WHITTLESEY,
MRS. F. E. BLAKEMAN.

REPORT OF THE COMMITTEE ON ACADEMIC STUDIES AND EDUCATION.

1. **General:** Inasmuch as an important phase of the function of an Agricultural College is found in the training of men and women to become leaders in the Community and in the state, as well as better fitted for the profession of agriculture it is not only advisable, but essential, that the training offered shall be such as to give a broad fourdation of liberal Education.

To this end the college now offers courses in which general or non-technical studies occupy about one-third of the student's time. The Committee approves of the proportion and recommends that not less than one-third of every student's time should be occupied with such non-technical studies as will tend to broaden his or her viewpoint and usefulness to the community.

It is generally admitted that it is difficult to interest technical students in academic subjects. To overcome this it is recommended that academic studies should so far as practicable be taught by "big" men and women, of strong personality, who will attract and influence students in their early years in College.

DEPARTMENTS

English:—It is recommended in order to meet the requirements of modern life, and to overcome the awe which the average student has for the study of English, that the teaching of "Practical" or "Vocational" English be developed rather than the overtechnical presentation of the subject.

The aim of the English Department should be development of ability to write and speak good English, and to encourage the love of good reading through interest in the best literature, current as well as classical, both vocational and general.

Debating and public speaking should be encouraged and developed in connection with the work in English, and emphasis should be put upon the value of training students to think and talk "on their feet."

Journalism is recommended as a part of the work in English. Not more than three courses should be offered, the aim being to develop a sort of vitalized English, to the end of gaining clearcut English expression in the several vocations.

The correlation of English with vocational or technical studies is strongly recommended and it is suggested that the use of good English in all written work, such as examinations and reports be encouraged by a merit system of marking, whereby care of expression as well as accuracy of knowledge be recognized in the marking of student papers.

Economics:—It is recommended that a general study of economics be required of all students and that more detailed courses be offered for those who specialize in teaching or extension work. For success in the presentation of this subject, it should be taught by a man of strong personality, and, like English, should be correlated with the technical studies as far as practicable.

A course is recommended, which shall embody the principles of civics, government, and the interpretation of Current Events. Elementary courses of this sort are given in many secondary schools but such a course in college should be so planned as to cover the subject more fully and in no sense seem to be a duplicate of the more elementary work.

History:—The present courses in History are far too meagre. The necessity of a good man on full time for the teaching of History should be recognized. A course suggested as required is one covering the Industrial and Economic History of the United States and England. To furnish a broader background for the teaching of History it is recommended that the College encourage in preparatory schools a return to the teaching of "General History."

Besides the course in History, it is recommended that every technical department of the college should devote a part of its time to the teaching of the history of the subject, because of its great value in leading to the fullest understanding of the technology of the subject.

Modern Languages:—French, German, and Spanish should all be offered and taught by competent instructors, but should not be required for graduation. In the teaching of languages great emphasis should be laid on the conversational method of teaching, whereby the student may become really acquainted with the language before being swamped in the maze of declensions, conjugations and syntax.

Education:—It is recommended that the courses in Education be made as practical as possible and that theory be reduced to the minimum necessary for efficiency. In order that the work may be real educational training for the students, a Junior High School should be established at Storrs before the next academic year. Such a school should serve both college and community and prove a demonstration school of state-wide significance.

The work in Sociology, and especially Rural Sociology, should be continued in close association with the work in Education and Economics. Sociology is as important as Economics for all students in agriculture and home economics, but to be of the most value should be based in part on a first-hand knowledge of the sociological conditions in the Storrs community.

Respectfully submitted,

HARRISON B. FREEMAN,
L. C. SLADE,
H. A. TIRRELL,
J. C. MOORE,
MRS. A. J. PIERPONT,
T. H. DESMOND.

REPORT OF COMMITTEE ON THE HOME ECONOMICS DEPARTMENT.

THE OBJECT

The object of the committee has been carefully to study:

1. What present service the Connecticut Agricultural College, through its Home Economics Department, is rendering to the state.
2. What the present and future needs of the state are for trained women workers; which needs the college may meet without undue expenditure of money.
3. What the college needs to render larger service to the state in training these women workers.

STUDY NO. 1

The present service the Connecticut Agricultural College is rendering the state through its Home Economics Department.

1. **Number of young women reached:**

No. enrolled 1919-20—62—88% increase.
" " 1918-19—33—13% increase.
" " 1917-18—31

The present four-year course was opened to women in 1915. There is yearly a larger number of young women applying. High School teachers tell us that more girls, many of whom do not enter any advanced school, would be interested in the college if the college could accommodate more and if the courses were arranged to suit a more varied need.

2. **Course Offered:**—The policy of the Home Economics Department in recent years has been to train teachers of Home Economics, the college having been designated by the legislature as the institution to receive Federal funds for that purpose under the Smith-Hughes law.

Many of the women students are not drawn to teaching. Like the men students they find applied science or social service arousing their interest. They desire training as dietitians or Extension Workers in Home Economics or that will make them efficient housewives and community leaders in rural districts. To limit the training to a restricted phase of women's work is to neglect an opportunity and a duty and to fail to make the most of the resources of the college.

3. **Number of Instructors:**—The number of instructors for Home Economics subjects is three, all of whom are also responsible for extension dormitory supervision. This is a limited number. An increased number of students naturally demands more teachers, which will lead to a greater specialization in the subject taught. This is of great advantage to pupils, teachers and college.

4. **The Equipment:**—The equipment, exclusive of the dormitories, is valued at $1,400; and the annual cost of maintenance, apart from salaries is $2,150. About two-thirds of the cost of all maintenance is met from Federal funds, and the Practice House and the course in advanced cookery are practically self-supporting. To develop the lines of work not possible under the Smith-Hughes funds would require increased support for personnel and a few new courses.

The girls' work was badly handicapped by the burning of Grove Cottage. One school teacher after visiting the college said she was surprised that the instructors were able to teach at all. A pupil who entered the college from an ordinarily equipped High School was irritated with the inconveniences. All workers know that to secure good results they must have good tools.

5. **Building:**—There is no Woman's Building. What college can expect to carry on a woman's department without adequate facilities for instruction and for housing? Grove Cottage before it was burned, functioned in this manner, but even that was inadequate. The girls have been housed in two old buildings with scarcely room for good living conditions. Laboratories for cooking and sewing have been improvised in the Poultry Building and Armory. First and foremost a Woman's Building is needed, adequate not merely to meet present needs but for the immediate future if possible. If the recent increase in women students continues, a building that would house one hundred girls would soon be insufficient.

The reasons which should appeal to a thinking public as to why a woman's building is needed.

1. **State Pride:**—Connecticut is justly proud of its state institutions. Can it be proud at present of the women's department of its state college? When a public spirited High School Teacher in the state says that she cannot conscientiously recommend girls to go to the college, there must be some reason why. The field of Home Economics has been a new field. It is as important as agriculture, perhaps even more so—for health is essential to sanity, strength, success and progress. To

develop with the times in these fields is essential to continued efficiency and confidence.

2. **A State Consciousness:**—A state college develops a sense of state loyalty among its young people. From a state college come the community leaders who give a just return to the state for the money invested in them.

3. **Constructive Work:**—The state college work is constructive, building toward the future. To invest for the future homes of the state is as important as caring for the dependents of the state.

4. **Rural Consciousness:**—It has been said that the cry among young people today is, "to the city." Connecticut cannot maintain its high degree of state efficiency if this continues. We must give the womanhood of our state a chance to appreciate that the farm is not a prison and that rural living does not need to be a hard existence.

5. **Democratic Spirit:**—A state college develops a democratic spirit as does no other institution of higher learning. All classes mingle at a state institution. This is necessary to meet the social conditions of today.

6. **Need of Higher Education:**—In this age of commercialism there is a larger and larger tendancy for less education. Young people who go through High School are receiving big pay for small jobs. The state should meet the situation by making higher education more accessible and attractive.

7. **Growth Limited:**—The college cannot now accommodate all the worthy students who apply. An average of fifty girls is all that can be accommodated because of living conditions; fifty girls, out of the whole state of Connecticut attending its state college! Further, the fifty girls cannot at the present time be taught as they should be, because of the physical limitations of the college.

8. **Individual Expense:**—Many girls cannot afford to go outside the state to secure their higher education. The expense item is too large a one for the family. For this reason the girl gives up all thought of further training and takes a less serviceable job, to wait until she is married. This plan does not develop a high type of womanhood throughout our state.

9. **Purpose of Courses:**—A state institution should appeal to a broader clientele than an endowed college. The College aim should be to benefit the state; to reach the largest number of people with the greatest efficiency. It should give as strong and efficient training in its regular four-year courses as can be found anywhere—a training that will fit the men and women for real service to the state, each according to his powers. It should go further and in addition to its degree giving courses, furnish practical technical training for men and women who cannot and should not undertake a four-year course. The standards

in all work should be high academically, but the institution's standard should be service.

10. **Health to the Individual and the State:**—Every person trained to do his part better because of his college work is a source of pride to the institution whether he stayed a long or a short time. Many girls are not physically quite strong enough to meet the living conditions which exist in many places of higher learning. Connecticut Agricultural College is especially favored by its healthful conditions and by the chances it offers to lead a healthful, normal life. A larger number of young women should have an opportunity of attending.

Conclusion:—For these and many more reasons, the college needs a larger women's department to adopt a definite policy for consistent growth to meet the increasing and rightful demand for more adequate and practical training of both urban and rural women.

STUDY NO. 2.

Needs of the state for trained workers; which needs the college might meet without undue expenditure of money.

1. **Home Economics Teachers Trained to Suit Connecticut Conditions, Rural Teachers as Well as City:**—This is the one field which the college at the present time has started to develop. There essentially should be three branches of this, with specialized study for each.

(1) Household Sciences, Cooking, Foods, Dietetics, etc.

(2) Household Art, Sewing, Millinery, etc.

(3) General or Vocational Home Economics, a general course for those who intend to teach all home-making subjects. Those who wish to teach in Vocational Home Economics schools of the state under the provisions of the Smith-Hughes law would probably need this course.

2. **Dietitians and Institutional Managers:**—At present the supply does not meet the demand. Hospital dietitians and cafeteria managers are needed and women are rapidly taking the place of men in managing restaurants and hotel dining rooms. School lunch rooms are increasing through the state.

3. **Social Service Workers:**—In both city and rural centers there are needed trained workers. Possibly we do not think of them all as social workers. There is at present a demand for (1) the visiting teacher. Many of our city and rural schools find this teacher invaluable. She must necessarily have home-making training. (2) Americanization teachers for women. Home-making has been found to be the best agency through which to reach the foreign mother. (3) Home Service Red Cross Workers. (4) Factory social workers. Women are taking these positions almost untrained in the home-making subjects. (5) Child Welfare Workers. (6) Rural traveling home economics teachers. (7) Extension workers, a field for which there should be definite training and which is hard to fill at the present time.

4. **General Science Teachers or Basic Training for Scientific Research:**—Schools today need teachers of science who can make a practical application of their science to everyday living, particularly in home garden work. In an agricultural college the scientific student has a greater opportunity to learn the practical application of the science than does the student in the academic or regular scientific school. Occasionally in an agricultural college a student will develop a bent along one definite scientific line. Opportunity should be given for the student to continue the work, whether man or woman. Women are particularly adapted for certain types of investigational work and for science teaching especially in the natural sciences.

5. **Agricultural Pursuits:**—Many women are managing farms today. The poultry line for one has been made a financial success by women. Connecticut must have efficient housewives also in rural communities. This need from the state-wide standpoint is one of the greatest needs in fact. If Connecticut farms are to continue to furnish food for Connecticut people, farm life and rural life must be made satisfactory in a broad way. Training women for home life in rural communities, ready to help make their communities better, must accompany the training of men as farmers. There will be no farming unless the home is preserved. The state needs trained, practical, country-loving rural home makers, or its rural life will become decadent and farming almost unknown.

STUDY NO. 3

What the college needs to render larger service to the state in training these women workers.

1. A Woman's Building with class room and laboratory accommodations and with a large room as a social meeting place to hold the women together; and dormitory rooms to accommodate an increasing number of students.

2. To have the Women's Department the School of Home Economics and have it fully considered a regular department of the college with a relatively minor fund for maintaining courses other than the teaching of home economics.

3. To have all courses in the college open to women. Of course those in home economics will be the most attractive, but others may be specialized in by women such as poultry, science, economics, etc.

4. To have a four-year course leading toward a degree with one course outlined for all, for the first and possibly the second years; then specialized work in the third and fourth years to suit the types of women workers as needed in the state (Study 2).

5. To have a two-year course for rural homemakers.

6. To have a two-year course in farm management for women.

7. To have a one-year course in home and farm management for mature women.

8. To have a summer course for teachers. Emphasize agriculture, home-making, dressmaking, general science, recent literature, current events, etc. With the situation as it is in regard to teacher supply, the state should do something to keep their teachers in the state and to allow them to grow. Storrs is a splendid location for an active summer school. It is a healthful summer resort and attractive; courses should be offered but they should not be too heavy for the average tired school teacher. Admit without examination, relinquish certain fees and offer some courses toward a degree to those who can meet the entrance requirements.

9. To have fixed courses, and yet flexible in order to suit the individual student. Fixed courses attract attention in the catalog and give a family and a girl an opportunity better to see what they are aiming toward. It takes far-seeing educators to make fixed courses, but in many ways it has been proven better than to leave it to the student to fill in the larger majority of her subjects as electives. She usually chooses for some immediate reason rather than future welfare. Institute a plan by which students will not be held back. This is becoming more and more necessary with home economics courses everywhere. Some enter college with no previous school home economics study; others have had a good deal. These should be allowed to take examinations at the college and enter the advanced work or to substitute another subject. There is too much to be learned today to force any student to while away his time while others are catching up.

10. To create a larger co-operation between the state educational organizations and the college. State and City school boards could cooperate so that teachers well trained would secure state positions. New York State requires teachers trained in state institutions to teach in their own state. There should be an organized publicity movement among the high schools of the state to show the youth of the state the opportunities of a state college. This has already been done to some extent. Senior Week-end is popular, but in some ways this is a little too late, because the High School pupil should be reached in the Sophomore year, and at the latest in the junior year for college stimulation. Six hundred dollars is no small sum to the ordinary family and not only the student but the family must get the college desire early in order to make it a possibility. If the dean of the Women's Department of the college could be given enough time to present the college opportunities for girls in local communities the growth of the work would be more rapid, both in student material and public support.

Signed

ANNIE J. ROBERTSON,
ORISSA M. BAXTER,
KATHERINE LUDINGTON,
MARY C. WHEELER,
CORINNE R. ALSOP,
URSULA E. AVERY, Chairman.

REPORT OF COMMITTEE ON APICULTURE, FORESTRY, LANDSCAPE GARDENING, POMOLOGY AND VEGETABLE GROWING.

We believe in the Connecticut Agricultural College and that there should be no good reason why it should not be one of the leading, if not THE LEADING institution of its kind in the United States. To achieve this will require the expenditure of considerable sums of money; but as the investment is in the young citizenship of the State, we as taxpayers and members of said committee heartily approve the recommendations below, that these departments that we have investigated may graduate men and women fully qualified, both practically and theoretically to take up these various subjects as either teachers, experimenters, or as a business, and feel assured that they have the best training possible, and are thus assured of success.

We make the following recommendations by Departments:

A. POMOLOGY, VEGETABLE GROWING AND LANDSCAPE

An implement and supply storage house is needed for these three departments, inasmuch as all need storehouses for tools. We found the offices and class rooms used for this purpose; which did not give a good impression until the reason was explained to us.

An Artificial Cold Storage Plant for the Vegetable and Pomology Departments:—For the preservation of their products for out-of-season study and economically to distribute their products over a longer season, thereby receiving the greatest remuneration.

Permanent Fields:—All the Departments need permanent fields for their work, permitting them to make these fields into the ideal condition for the purpose desired.

Greenhouses for Vegetable, Landscape and Floriculture Departments:—The Vegetable and the Landscape Departments each need suitable glass houses for use in properly instructing students in the full details of their respective courses.

B. APICULTURE DEPARTMENT

The Apiculture Department needs: A new building suitably arranged for laboratory, class room, offices and storage; a stenographer or clerk. Some one should be in charge at all times to answer telephone and take care of the correspondence, leaving the head of the department free for outside work and to maintain an efficient department.

An assistant is needed for six months of the year, for apiary work from May first to October fifteenth each year.

C. LANDSCAPE DEPARTMENT

Larger funds are needed for maintenance of grounds. The present amount allowed to the Landscape Department for the care of grounds is entirely inadequate and Mr. Fraser has done wonderfully well with the funds at his disposal. We recommend that he have sufficient funds to make these grounds comparable with those of other state institutions.

Adequate lighting system for roads and grounds to make the grounds safe for students, faculty and visitors.

An incinerator for the disposal of refuse.

D. POMOLOGICAL DEPARTMENT

Opportunity for experimental work and orchard development. This work is of great importance to the student and to the growers of the state.

E. FORESTRY DEPARTMENT

The Forestry Department should have a man on full time. A combination course of Landscape and Forestry is desirable. These subjects could easily be combined in a course as they cover the same ground in many instances.

F. IN GENERAL

More practical and commercial work in the Departments where possible.

Adequate funds to maintain all of the Departments up to a standard.

A twelve months' college year enabling the students to follow the full year in the various departments. Much of the valuable work is done during the vacation months in all of the departments covered by this report. In Apiculture, Vegetable Growing, and Pomology, the summer months are the most valuable as then is when most of the difficult problems arise.

We realize that we are adding materially to the budget of the college, but feel that the college is a business institution and its products are the young men and women who come there for instruction and that there is no better way to make the college a failure than to send out graduates who have not a practical knowledge of the subjects in which they have specialized. Therefore, our recommendations are almost entirely along lines that when carried out will give the student the same practical contact with his subjects that he will have when he strikes out for himself in his chosen occupation, and thereby be relieved of some serious mistakes and failures.

Signed,

STANCLIFF HALE, Chairman.
W. R. PEARSON,
W. H. BENHAM,
A. W. YATES,
GEORGE DREW
LOUIS ST. CLAIR BURR.

REPORT OF COMMITTEE ON MECHANICAL ENGINEERING.

The Committee appointed to investigate the needs of the Mechanical Engineering Department, having visited the college, and inspected the equipment and working conditions of the department, submits the following report:

1. The College has a duty to develop the Engineering branches, because of Federal appropriations received, which contemplated the development of agriculture and the mechanic arts. Of the forty-eight Land Grant Colleges, forty-six give engineering courses. In the event of Government appropriations for Engineering Experiment Stations this college would be in a better position to receive and expend the funds, if properly equipped in its engineering department.

2. During recent years the standard of scholarship has been raised from a school to a college basis in the four-year courses in Agriculture, Home Economics and Science. This committee recommends that the Mechanical Engineering Course be established on a parity with these.

3. There is needed for equipment forty-five thousand dollars ($45,000), to supplement the present outfit for shop-work and to purchase strictly engineering apparatus for instruction.

4. Students enrolled in the engineering courses at the present time are high-grade in scholarship, but some are leaving Storrs because of inadequate equipment for teaching engineering after the first year.

5. Engineering courses are being given successfully in Land Grant Colleges more remote from industrial centers than is Storrs. A high-grade engineering course at the Connecticut Agricultural College should attract and hold a reasonable number of students and be of great value to the industries of our state.

Signed,

E. C. WELDEN,
C. C. ELWELL,
G. H. HOLLISTER,
H. R. BUCK,
A. D. BOSS,
Committee.

The Mechanical Engineering Department Budget for the Period, July 1, 1921—July 1, 1923, as Recommended by the Pilgrimage Committee.

A one-story brick forging building, 34 x 66 feet, matching the architecture of the Engineering Building	$15,000
12 double down-draft forges, equipment installation	10,000
6 wood-turning lathes	1,000
6 metal-turning lathes	2,000
6 other wood-working machines	2,000
Necessary shafting, tools, belting, etc.	1,000
Fitting up demonstrating class room	1,000
20 drafting tables, blueprinting equipment, filing cabinets, etc.	1,000
Strength testing, power testing, and other scientific apparatus needed for technical instruction in mechanical engineering	12,000
Total, forty-five thousand dollars	$45,000

REPORT OF COMMITTEE ON POULTRY HUSBANDRY.

Hartford, Connecticut, August 3, 1920.

Mr. E. G. Hill,
Hartford Times,
Hartford, Connecticut.

Dear Mr. Hills:

The committee on Poultry Husbandry has made an investigation of this department of the College and begs to report its findings as follows:

We find the buildings and equipment inadequate to do the work now at hand, to say nothing of the justification for expansion of the college and its activities. Not only this, but the department's personnel is insufficient to carry on its expanding work. Some of the records are not only months, but years behind, which means that valuable information, which should be available for the citizens of the state, is lying in the vaults for lack of help to prepare it for the public's use. We strongly urge that the poultry department of our state college be supported in such a way that it can continue the supremacy it has attained through its International Egg Laying Contest, the Home Egg Laying Contests, its investigational work and its Extension Service, all of which have been most valuable, not only to Connecticut, but also to other states as well. In the experimental field there are almost unlimited possibilities which obviously cannot be developed and used without sufficient funds. The value of this work has been amply demonstrated through the activities of this department of the college in its discovery of the cause and methods of combating white diarrhoea in chicks, and in its efforts, through direct application to the farms of the state, to eliminate perhaps the greatest menace to poultry keeping in Connecticut. Research work in other lines is now being carried on, but only to a more or less limited extent, special attention being paid to problems of breeding and diseases of poultry.

We are confident that past results justify enlarging the scope of this work. We consider poultry husbandry one of the most important departments of the college. Poultry products are as important as any other article of human diet. The business is appropriate for a greater number of residents of the state than any other in which the college is interested, practical results are more rapid than in any other, and poultry appeals to a much larger percentage of the population.

The climate of Connecticut is as well suited to poultry husbandry as any other state in the union. Other states and even other countries come to Connecticut for instruction, encouragement and inspiration through its laying contests, its research work, its feeding standards and its extension service. It is a well-known fact that there are not enough eggs produced in the state to supply the city of New Haven and in view of our industrial over-development during the past five or six years it is peculiarly fitting and important during the coming years that poultry keeping be encouraged and fostered as a means of striking a better balance between agriculture and industry or for the benefit of the entire population. Much of this work must be done first of all by experimentation, through teaching the young men and women students of the college, and by the Extension Service through personal work of its representatives especially trained to do these things.

To the best of the committee's knowledge and belief the Poultry Department of the college during the past seven years has received from the state but one special appropriation for enlarging, improving and maintaining its physical plant. This special appropriation of $10,000 was made nearly four years ago but when the funds became available they were not promptly expended because our country was at war. Meanwhile the rise in prices of all commodities resulted in the Poultry Department's getting only a little more than one-half as much for the money appropriated as it planned for and would have obtained under more favorable circumstances. Thus the recommendations below, as a matter of fact, cover needs that have long been recognized.

The Committee recommends for your careful consideration the following special appropriation which it considers imperative to the needs of the department in question:

Building and equipment for the plant	$15,000
Addition to the administration building	10,000
*Salaries for increased personnel — annual two years	18,000
Secretarial and student help—annual two years	4,000
	$47,000

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*This will provide for perhaps not more than three additional men, one additional instructor and assistant to the head of the department, one additional man in the Extension Service with his traveling expenses and a full time poultry pathologist under direction of the department.

Respectfully submitted,

L. A. GROUTON,
PAUL P. IVES,
A. B. HALL,
S. W. EDDY,
MARGERY M. BREWSTER,
FRANK K. HAINES,
ARTHUR J. BIRDSEYE, Chairman.

REPORT OF COMMITTEE ON SCIENCE.

The Committee appointed to investigate the needs of the Connecticut Agricultural College as to facilities for Science instruction submits the following report:

From figures submitted by members of the Science Department it appears that there has been a growth of over 100% in the enrollment at the college during the past ten years; that the number of Science courses has more than doubled in that time; and that there has been a corresponding increase in the number of pupils taking the Science work. A study of the courses indicate that there has been a constant improvement in the character of the work given, and that the courses, as laid out, are fully on a par with those in other institutions of the same grade.

The loss of the Chemical Laboratory, which was burned three years ago, has been a serious one, and the work of the Science Department is seriously crippled on account of crowding.

The Committee is of the opinion that there is a great and immediate need of a new science building and of additional equipment, and would recommend an appropriation to properly take care of the growing needs of the department.

The Committee would call attention to the increasing part that Science plays in the study of agriculture. No agricultural course would be complete that did not offer the fullest facilities for the study of Physics, Chemistry, Botany, Zoology and Geology, together with their various sub-divisions.

The Mathematics Department also requires more space, and it could be properly accommodated in the building devoted mainly to Science, to which subject it is closely related.

Respectfully submitted,

F. M. COWLES,
G. E. GOODRICH,
W. D. HOOD,
C. C. HYDE,
W. S. MOYLE,
MRS. J. A. SHERWOOD.

REPORT OF COMMITTEE ON STUDENT ACCOMMODATIONS AND ACTIVITIES.

The Committee on Student Accommodations and Activities has considered the problems assigned to it, notably those concerned with the housing of students and with their various non-scholastic activities, and submits the following report:

The Committee feels that in all lines the College has behind it an excellent record of accomplishment, of which the state should be proud; but it also believes that a lack of adequate physical facilities has prevented a still greater usefulness for the institution. Connecticut should have a State College second to none, and should far more generously support an institution which is so evidently capable of yielding high returns in service.

Since the living conditions under which student life is carried on are vitally important in determining whether or not that life shall develop soundly and fruitfully, the Committee believes that the present inadequacy at the college in dormitory facilities is very deplorable, and in fulfillment of its task desires to offer the following recommendations, arranged in what the Committee believes to be the order of their importance:

1. A new Woman's Building, capable of housing from 100 to 125 students, and with facilities for all the class, laboratory and office work in Home Economics, should be erected at once. This the Committee believes to be the most vital need of the institution's physical plant, and to be absolutely essential if the college is to serve effectively in training young women.

2. Two Men's Dormitories, equal in size to those already built, should be erected as soon as possible, one of them immediately. The Committee feels that although the housing conditions for the men are not at first sight so obviously inadequate as are those for the women: nevertheless the fact that next year many men will be forced to live outside the dormitories under cramped conditions, and that even in the dormitories it is necessary to crowd four men into a suite designed for two, makes it very difficult for students to enjoy the privacy and quiet needed for thorough scholastic accomplishment.

3. A building to serve as a College Union should certainly be erected in the near future, to function as a center for the social life of the student body and as headquarters for the various student organizations (exclusive of fraternities) and all other extra-curricular activities. It should contain a large auditorium where the whole college could meet for the weekly Assembly period, for entertainments and on other occasions. This building would minister effectively to the welfare of the college by serving as a strong centralizing agency in the student life.

The Committee believes that the Alumni of the institution should take the initiative in securing funds for such a College Union, and undertake its erection. If sufficient funds are not forthcoming from this source, an appeal should be made to the General Assembly for financial assistance in bringing the project to completion.

The Committee sees much of good in clubs and fraternities in the student body, and feels that such organizations play an important and useful part in college life. As a matter of general policy, however, it believes that fraternities should not be encouraged to build for themselves separate houses where their members would be provided with accommodations for eating and sleeping, and would thus live more or less isolated from the remainder of the institution. Such a system, although established in many colleges, often fails to give satisfaction, since it is essentially divisive in its nature. No objection could be raised to the erection of a small house by each fraternity as a club room (possibly to include a kitchenette, for informal suppers, etc.), which the organization would use as its social headquarters, much as it now uses its fraternity room, but which should not serve as living quarters. The Committee recommends that ample dormitory and dining hall facilities be provided as the institution grows, in order that in these essential living conditions the students may be united rather than divided.

4. The Committee looks with favor on the establishment of a fund to bring distinguished speakers before the student body but considers that this is essentially a matter of educational policy which should come before the Executive Committee.

Signed,

N. H. BATCHELDER, Chairman,
F. H. SILL,
HELEN L. CLARK,
MORRIS E. ALLING,
ARTHUR HOWE,
ANNIE E. CLARK.

REPORT OF THE SUB-COMMITTEE ON ECONOMICS AND FARM MANAGEMENT.

The sub-committee on Economics, Marketing and Farm Management appointed to investigate the work of the College in the above subjects has given careful study and consideration to the questions involved and has come to the following conclusions:

We endorse the start already made by the College in this work as being in the right direction and of tremendous value to itself and to society.

We urge the provisions of ample means and facilities for the extension of these activities and building-up of definite, permanent departments in these fields.

We especially stress the need of investigational and research work as vital and fundamental to the business and economic phases of farming, as well as to sound teaching, both at the College and in the State.

We have given careful consideration to the problems involved, as to their effect on the College, the farmer and the public, and we unanimously recommend that, in addition to the funds now being used by these departments, the sum of ten thousand dollars ($10,000) annually be made available to them to:

a. Conduct investigational work in Marketing.

b. Conduct investigational work in Farm Management.

c. Provide adequate clerical and office facilities for such investigational work.

For your further information we append below the formal resolutions adopted by the committee:

Whereas: A thorough knowledge of economic principles and an understanding of the operation of our modern economic, business and political machinery and institutions is equally essential to business success and to the performance of the duties of citizenship, and,

Whereas: The program of the departments of Economics and Farm Management serves the above ends,

Resolved: That we endorse the work already done by the College in this field as being in the right direction and of tremendous value to itself and society.

Whereas: The Market Information Service is furnishing daily the most important local market information to 650 farmers who are direct subscribers and to tens of thousands of farmers and consumers of farm products through its publication in the daily papers of our four large cities and

Whereas: Many farmers and consumers, including the members of this committee, have testified to its value,

Resolved: That it is the opinion of the committee that the Market Information Service (so-called) performs a valuable and indispensable service. The committee recommends that this service be continued as at present conducted.

Whereas: Investigation and teaching of the economic and business phases of farming are of recent development and have lagged behind the investigation and teaching of processes of production,

Whereas: It is true that the former are equally essential with the latter if the farmer is to develop as a successful business man and an efficient producer of the goods required by the consuming public, and

Whereas: Upon such business success depends the existence of progressive farming in Connecticut and upon such efficient production and efficient distribution depends the opportunity of the consuming public to secure the goods it needs in adequate quantity, of desirable quality, and at reasonable price:

Resolved: That it is the unanimous opinion of the committee that the success with which the College serves the agricultural and economic life of the State in the next decade will depend to a large extent on its ability to give the student, whether he be resident at the College or an extension student in the State, that training and instruction which will enable him to solve successfully the problems of management. marketing and business relationship which he is to face in the world.

Resolved: That the committee recommends as essential to the proper development of the College and as in the interest of the whole public, that a proper knowledge and understanding of the marketing and farm management problems of the State be secured through the establishment and carrying on of investigational work, both in farm management and in marketing.

Resolved: That to make a beginning in such investigational work, a properly trained investigator should be employed for each line of investigation, travel funds provided and adequate clerical service provided, the committee recommends that $10,000 annually be made available for this work.

Whereas: Funds appropriated for Extension work in Farm Management are now used for Investigational work in that field,

Resolved: That it is the opinion of the committee that as soon as investigational funds can be made available, the Extension funds freed by this action should be used for purposes of Extension work in Farm Management.

Whereas: Neither the Department of Economics or the Department of Farm Management has at present permanent headquarters or any center for accumulating, organizing and using the maps, charts and statistics which constitute the teaching material of the subjects of Economics and Farm Management, and

Whereas: Portions of such teaching material can be used interchangeably by either Department,

Resolved: That it is the sense of the committee that adjoining departmental centers should be provided in some building of the College, with sufficient funds to accumulate adequate teaching material, including books, maps, statistical data, etc., with departmental offices, a seminar room, a statistical room and if possible a class room.

The Committee,

R. LaMotte Russell, South Manchester, Conn.
W. P. Robertson, Hartford, Conn.
R. K. Clapp, New Haven, Conn.
Elijah Rogers, Southington, Conn.
A. W. Sweeton, Canton Center, Conn.
J. C. Stremlau, Allyn House, Hartford, Conn.
Fred H. Beers, Brookfield, Conn.

SUMMARY OF REPORTS OF PILGRIMAGE SUB-COMMITTEES.

Administration and Library:—

Buildings and Equipment—First Needs:—

- Woman's Dormitory for 100-125 students.
- Men's Dormitory for 100 students.
- Additional filter beds.
- Improved facilities for hauling coal.

Maintenance and Staff:—

- Survey by Board of Fire Underwriters.
- Increased maintenance fund.

Agronomy and Agricultural Engineering:—

Buildings and Equipment:—

- More land for experimental work.
- Agronomy building.

Maintenance and Staff:—

Funds for experimental work on pastures, crop rotations, use of fertilizers, adaption of farm machinery, soil survey of state.

Animal Husbandry:—

Building and Equipment:—

- Tool shed and shops.
- Judging ring.
- Horse barn and beef barns.
- Boarding house.
- Granary and freight depot.
- Truck and tractor.

Maintenance and Staff:—

- Permanent blacksmith.
- Improve Percherons and increase Belgians.
- Improve Hereford herd and improve Shorthorn herd.
- Increase sheep in numbers and variety.
- Add Durocs to swine herd.
- Employ swine specialist.

Policy:—

Ice should not be delivered by farm.

Dairy herd put under full control of Animal Husbandry Department.

Law repealed forbidding competitive exhibition of stock at fairs in state.

Buildings for stock, and instruction be grouped.

Future building according to complete plan.

Dairy:—

Buildings and Equipment:—

- Young stock barn.
- Milk room.

Refrigerating plant.

Research laboratory and equipment.

Herd doubled.

Maintenance and Staff:—

Two graduate assistants.

Policy:—

Dairy herd to be managed by Animal Husbandry Department.

Creamery developed as a commercial plant, including the manufacture of new milk products.

Experiment Station:—

Buildings and Equipment:—

Station barn, $10,000.

Maintenance.

Annual appropriation increase to $20,000.

Home Economics:—

1. Buildings and Equipment:—

Woman's building, the foremost need, properly equipped.

2. Policy:—

1. Should train Home Economics teachers; Dieticians and institutional managers; Social Service Workers; General Science Teachers; Specialized Farmers.

2. Four-year course—first two years same for all; last two years specialized.

Two-year course for rural homemakers.

Two-year course in farm management.

One-year course in home and farm management for mature women.

Summer course for teachers.

3. Larger co-operation between state educational organizations and the college.

Academic.—

Maintenance and Staff:—

Full time man for history.

Policy:—

One-third work in non-technical subjects.

English practical and used in other departments.

History—Economic and industrial.

Economics required.

Language elective and by conversational method.

Journalism—three courses at most.

Apiculture, Forestry, Landscape Gardening, Pomology and Vegetable Growing:—

Buildings and Equipment:—Pomology, Vegetable Growing, Landscape.

Storage house.

Cold storage plant.

Greenhouse.
Permanent fields.
New building—Apiculture.
Lighting system for roads and grounds.
Incinerator.

Maintenance and Staff:—
Clerk for Apiculture.
Assistant for six months, Apiculture.
Funds for experimental work and orchard development.
Full time man in forestry.
Adequate funds to maintain departments up to a standard.
Larger funds for grounds.

Policy:—

Year round academic year.
More commercial work in departments concerned.

Mechanical Engineering:—

Buildings and Equipment:—
Forging building and equipment, $45,000.

Policy:—

Engineering course be strengthened to equal other courses in scholarship and attractiveness.

Poultry:—

Buildings and Equipment:—
Plant, $15,000.
Building, $10,000.

Maintenance and Staff:—
Three additional men, $18,000 (2 years).

Policy:—

Extension and experimental work increased and present reputation maintained.

Science:—

Buildings and Equipment:—
New Science building and equipment.

Maintenance:—
Appropriation for needs of maintenance to a high standard.

Policy:—

Science subjects increasingly important and present standards should be maintained.

Student Accommodations.—

Buildings and Equipment:—
Woman's building.
Two men's dormitories, one at once.
College Union, by Alumni.

Policy:—

Fraternities should not have board and living rooms, but should have separate houses for clubrooms.

Ample dormitory and eating quarters as institution grows.

Funds should be established to bring distinguished speakers to the college.

Economics and Farm Management Buildings and Equipment:—

Departmental center, with adequate teaching material, statistical room.

Maintenance:—

Funds for carrying on investigational work in Economics and Farm Management, with at least $10,000 annually available for such work.

Funds to accumulate adequate teaching material.

Policy:—

Market information service continued as now conducted.

Investigational work done in the problems of farm management and agricultural economics of the state.

Investigation work should not be carried on by Extension Service as soon as other funds can be made available.

Part III.

FINANCIAL REPORT

REPORT OF TREASURER
FOR PERIOD OCTOBER 1, 1918, TO JUNE 30, 1919

TOTAL INCOME ALL DIVISIONS

College Division	$173,164.59	
Extension Division	57,640.57	
Experiment Station Division	20,061.02	
Gilbert Farm Division	3,994.46	
		$254,860.64
Buildings and Improvements		24,462.39
		$279,323.03
Funds Balance October 1, 1918		12,444.85
		$291,767.88
Accounts Receivable, Balance October 1, 1918		7,628.61
		$299,396.49

TOTAL EXPENDITURES OVER RECEIPTS ALL DIVISIONS

College Division	$148,517.86	
Extension Division	41,404.02	
Experiment Station Division	17,317.54	
Gilbert Farm Division	13,524.81	
		$220,764.23
Buildings and Improvements		16,332.51
		$237,096.74
Funds Balance June 30, 1919		38,662.59
Accounts Receivable, Balance June 30, 1919		6,095.56
Mortgages and Notes Receivable		17,541.60
		$299,396.49

COLLEGE DIVISION

Income Appropriations

Appropriation for Maintenance, Legislature 1917	$52,500.00	
Special Deficiency Appropriation, Legislature 1919	30,000.00	
Interest Agricultural College Fund (Land Grant)	5,062.50	
State Board of Education, Smith-Hughes Act (Federal)	6,739.78	
Special Appropriation Sheep Distribution, Legislature 1919	10,000.00	
Hicks Endowment Income	45.00	
		$104,347.28

Other Income

Rent	$7,040.38	
Fees	34,761.21	
Sale of Dunham Farm	20,514.81	
Reimbursement of State Maintenance Fund for Purchase of Miller Farm in 1918 from Buildings and Improvements Appropriation, Legislature 1917	5,000.00	
Interest on Bank Balances	692.58	
Refund of Compensation Advanced to Mrs. Jacob Boglisch, 1917-1918	567.50	
Miscellaneous Receipts	240.83	
		68,817.31
Balance Appropriation Buildings and Improvements 1917		24,462.39
		$197,626.98

Fund Balances September 30th, 1918

	Dr.	Cr.	
State Maintenance Fund (Overdraft)	$56,816.51		
Land Grant Fund (Overdraft)	472.98		
Smith-Hughes (Overdraft)	437.49		
Morrill Fund		$42,064.19	
State Scholarship Fund		3,587.74	
Special Scholarship Fund		75.00	
E. O. Smith Loan Fund		30.00	
Hicks Prize Fund		226.70	11,743.35
	$57,726.98	$45,983.63	$185,883.63
Accounts Receivable, Balance October 1st, 1918			6,179.87
			$192,063.50

ACCOUNTS SHOWING EXCESS OF EXPENDITURES OVER RECEIPTS COLLEGE DIVISION

OCTOBER 1, 1918, TO JUNE 30, 1919

Summary

Administration (Schedule A)	$16,513.67	
Departments of Instruction (Schedule B)	70,351.38	
Repairs and Maintenance (Schedule C)	56,137.92	
Supplies and Service to Students (Schedule D)	1,722.52	
Departments not included in Budget (Schedule E)	3,679.87	
		$148,405.36

Buildings and Improvements Account

Expenditures, Balance Appropriation, Legislature 1917 (Schedule F)	$13,332.51	
Expenditures, Appropriation, Legislature 1919 (Schedule G)	3,000.00	
		16,332.51

Other Expenditures

E. O. Smith Loan Fund	$30.00	
Compensation advanced to Mrs. Mary Boglisch (3 months)	82.50	
		112.50
		$169,959.37

Fund Balances June 30, 1919

	Dr.	Cr.	
State Maintenance Fund (Overdraft)	$3,723.15		
Smith-Hughes Fund (Overdraft)	3,424.91		
Hicks Prize		$271.70	
Special Sheep Distribution Fund		10,000.00	
Special Scholarship Fund		75.00	
State Scholarship Fund		2,046.14	
	$7,148.06	$12,392.84	Cr. 5,244.78
Mortgages Receivable, Dunham Farm			16,000.00
Scholarship Notes Receivable			1,541.60
Accounts Receivable			4,426.75
			$192,063.50

GENERAL ADMINISTRATION EXPENSES IN EXCESS OF RECEIPTS

Schedule A.

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Officers' Salaries	6787.35	....	....	....	6787.35	900.00	5887.35
Office Employees	5965.51	....	....	....	5965.51	2394.00	3571.51
Postage and Office Supplies	....	....	2328.92	....	2328.92	1261.90	1067.02
Traveling Expense	....	....	....	1077.69	1077.69	323.00	754.69
Trustees' Expenses	....	....	....	508.58	508.58	193.00	315.58
Publicity Com.	715.35	351.13	2579.77	358.81	4005.06	90.89	3914.17
Tel. and Tel	300.00	....	1482.70	....	1782.70	1182.78	599.92
Ent. of Guests	....	....	....	59.80	59.80	....	59.80
Misc. Expense	....	....	681.27	....	681.27	337.64	343.63
	13,768.21	351.13	7072.66	2004.88	23196.88	6683.21	16513.67

DEPARTMENTS OF INSTRUCTION

Schedule B

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Agronomy	2987.10	651.00	776.16	23.09	4437.35	68.80	4368.55
Agr. Education	1312.47	....	86.53	9.53	1408.53	73.49	1355.04
Apiculture	1094.40	4.30	915.28	....	2013.98	57.46	1956.52
Bacteriology	2849.94	321.36	843.63	....	4014.93	365.14	3649.79
Botanical	1874.97	199.23	200.51	....	2274.71	4.00	2270.71
Chemistry	2774.97	329.72	1284.18	17.94	4406.81	....	4406.81
Creamery	881.75	2388.80	14614.68	176.07	18061.30	14538.63	3522.67
Dairy	1549.06	2474.02	10766.58	82.06	14871.72	10299.74	4571.98
Eng. and History	3783.30	65.17	....	....	3848.47	....	3848.47
Farm	2699.91	10944.25	11016.45	234.97	24895.58	15696.18	9199.40
Forestry	750.00	958.47	517.84	....	2226.31	1044.94	1181.37
French	2220.00	....	21.77	14.05	2255.82	....	2255.82
Gardening	1499.94	427.84	834.50	....	2762.28	842.05	1920.23
German	375.03	....	.64	....	375.67	....	375.67
Greenhouse	450.00	1361.37	208.74	....	2020.11	503.92	1516.19
Grounds	675.00	1628.26	812.99	....	3116.25	154.43	2961.82
Grove Cottage	....	66.60	104.40	....	171.00	10.30	160.70
Home Economics	3688.64	133.80	1660.32	....	5482.76	259.07	5223.69
Library	....	394.42	913.56	....	1307.98	40.00	1267.98
Math. and Physics	1649.97	258.83	666.82	....	2575.62	106.10	2469.52

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Mechanic Arts	1499.94	72.91	436.06	....	2008.91	92.20	1916.71
Military	....	145.86	367.99	37.05	550.90	112.93	437.97
Poultry	2531.16	804.58	1436.15	14.55	4786.44	295.84	4490.60
Pomology	1274.94	1244.93	1407.46	....	3927.33	3110.06	817.27
Zoology	2493.70	34.54	670.69	....	3198.93	2.22	3196.71
Veterinary Science	240.00	1.25	....	....	241.25	....	241.25
Journalism	....	....	.40	....	.40	....	.40
Physical Education	567.50	153.62	224.82	....	945.94	158.40	787.54
	41,723.69	25065.13	50789.15	609.31	118187.28	47835.90	70351.38

REPAIRS AND MAINTENANCE

Schedule C

Departments	Salaries	Labor	Supplies	Total	Receipts	Balance
	$	$	$	$	$	$
Engineers and Firemen	....	4536.79	....	4536.79	....	4536.79
Fuel and Light	....	....	22360.69	22360.69	2553.60	19807.09
Janitor Work	675.00	803.85	338.55	1817.40	23.92	1793.48
Cent. Heating Plant	....	521.51	903.36	1424.87	74.33	1350.54
Insurance	....	....	2099.51	2099.51	78.83	2020.68
Repairs to Buildings, Labor and Supplies	....	....	26629.34	26629.34	....	26629.34
	675.00	5862.15	52331.45	58868.60	2730.68	56137.92

SUPPLIES AND SERVICE TO STUDENTS

Schedule D

Departments	Salaries	Labor	Supplies	Total	Receipts	Balance
	$	$	$	$	$	$
Lectures and Entertainments	172.15	....	29.26	201.41	52.49	148.92
Pew Rent	....	....	599.94	599.94	....	599.94
Nurse and Medical Services	....	643.87	335.94	979.81	6.15	973.66
	172.15	643.87	965.14	1781.16	58.64	1722.52

MISCELLANEOUS DEPARTMENTAL EXPENDITURES NOT INCLUDED IN BUDGET

Schedule E

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Boarding	....	6361.45	43089.89	31.03	49482.37	48340.08	1142.29
Competition	216.67	2368.60	5648.74	19.16	8253.17	7308.89	944.28
Military Misc.	....	....	169.81	....	169.81	....	169.81
Print Shop	....	1123.24	607.56	2.66	1733.46	1279.63	453.83
Practice House	....	17.30	370.82	....	388.12	152.20	235.92
Apartment for Office Employees	....	....	724.54	....	724.54	....	724.54
Dunham Farm Acct.	....	....	9.20	....	9.20	....	9.20
	216.67	9870.59	50620.56	52.85	60760.67	57080.80	3679.87

DEPARTMENTS SHOWING EXCESS OF RECEIPTS OVER EXPENDITURES

Balance Credited to Miscellaneous Receipts

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance Cr.
Book Store	149.95	626.52	17432.89	4.31	18213.67	18411.24	197.57
Laundry	....	....	507.49	....	507.49	550.75	43.26
	149.95	626.52	17940.38	4.31	18721.16	18961.99	240.83

EXPENDITURES—APPROPRIATION BUILDINGS AND IMPROVEMENTS LEGISLATURE OF 1917

Schedule F

Sewage Pump	$706.27	
Reservoir	534.45	
Poultry Buildings	2,199.28	
New Piggery	1,676.67	
Coal Bunker	971.12	
Artesian Well	302.68	
Farm Wagon Shed	20.00	
New Pump House	226.75	
Central Heating Plant, payment on boilers	1,695.29	
Miller Farm, Reimbursement of State Maintenance Fund for purchase of 1918	5,000.00	
		$13,332.51

Schedule G

Expenditures, Appropriation, Legislature 1919—

Payment on Hauschild Cottage, No. 3	$2,000.00	
New Dining Hall	1,000.00	
		$3,000.00

STATEMENT SHOWING ACCOUNTING OF TOTAL FUNDS

Fund Balances October 1, 1918				$12,444.85
Accounted for as follows—				
Cash in Vault	$1,770.32			
Less Student Bank	1,061.83			
		$708.49		
Middletown National Bank		10,938.46		
First National Bank, Stafford Springs		7.00		
Windham National Bank		22.99		
Willimantic Trust Co		3,867.74		
			15,544.68	
Less Hartford Trust Co., Overdraft			3,099.83	
				$12,444.85
Fund Balances June 30, 1919—				
		Dr.	Cr.	
State Maintenance Fund (Overdraft)		$3,723.15		
Extension Fund			$17,309.48	
Experiment Station Fund			7,455.77	
Gilbert Fund			8,652.56	
Smith-Hughes Fund		3,424.91		
Hicks Prize Fund			271.70	
Special Scholarship Fund			75.00	
State Scholarship Fund			2,046.14	
Special Sheep Distribution Fund			10,000.00	
		$7,148.06	$45,810.65	Cr.$38,662.59

Accounted for as follows—

Cash in Vault	$3,208.53		
Less Student Bank	717.37		
		$2,491.16	
Hartford Trust Co.		2,418.73	
Willimantic Trust Co		3.944.48	
Windham National Bank		15,000.00	
Middletown National Bank		14,808.22	$38,662.59

EXTENSION SERVICE DIVISION

Income

Appropriation Board of Control	$15,000.00	
Special Deficiency Appropriation, Legislature 1919	35,000.00	
Miscellaneous Receipts	195.47	
Smith-Lever Act, Federal Appropriation	7,445.10	
		$57,640.57
Accounts Receivable, Balance October 1, 1918		306.93
Fund Balance October 1, 1918		773.30
		$58,720.80

SUMMARY

Expenditures Over Receipts

State Fund (Schedule A)	$26,281.13	
Smith-Lever Federal Fund (Schedule B)	10.720.85	
Smith-Lever State Fund (Schedule C)	4,402.04	
		$41,404.02
Fund Balance, June 30, 1919		17,309.48
Accounts Receivable, Balance June 30, 1919		7.30
		$58,720.80

EXTENSION SERVICE DIVISION

STATE FUND

Schedule A

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Administration—Special	....	....	3489.00	....	3489.00	....	3489.00
Administration	1849.60	140.10	889.72	38.04	2917.46	340.51	2576.95
Agronomy	1055.00	....	74.50	748.44	1877.94	1050.00	827.94
Agr'l Economics	1523.32	3.30	192.25	1191.29	2910.16	168.16	2742.00
Apiculture	127.50	3.85	89.09	208.22	428.66	62.50	366.16
Boys' and Girls' Club Work	635.00	24.76	1091.22	267.34	2018.32	287.28	1731.04
Contingent	80.00	2.40	2128.06	1821.20	4031.66	2607.09	1424.57
County Agents	....	27.45	314.90	416.30	758.65	42.00	716.65
Dairy	403.48	9.66	75.28	282.19	770.61	39.14	731.47
Extension Schools	56.08	8.70	250.29	149.51	464.58	....	464.58
Fair Exhibits	....	15.40	79.80	64.24	159.44	....	159.44
Farm Management	517.50	....	63.40	373.20	954.10	17.75	936.35
Fruit	379.98	....	18.83	168.57	567.38	....	567.38
Home Economics	883.71	6.80	430.79	551.11	1872.41	139.09	1733.32
Poultry	259.99	3.97	71.73	....	335.69	....	335.69
Publications	2093.22	26.52	2921.61	635.90	5677.25	68.10	5609.15
Sheep	....	....	43.50	524.10	567.60	....	567.60
Swine	414.21	.50	471.11	579.97	1465.79	163.95	1301.84
	10278.59	273.41	12695.08	8019.62	31266.70	3985.57	26281.13

EXTENSION SERVICE DIVISION

SMITH-LEVER FEDERAL FUND

Schedule B

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Agronomy	1350.00	....	....	....	1350.00	....	1350.00
Administration	636.03	13.22	23.44	213.58	886.27	....	886.27
Boys' and Girls' Club Work	267.00	16.10	15.80	759.48	1058.38	....	1058.38
County Agents	4125.42	3.40	1.80	270.90	4401.52	30.00	4371.52
Dairy	199.98	....	1.90	249.46	451.34	138.39	312.95
Home Economics	210.00	....	5.52	795.75	1011.27	27.09	984.18
Poultry	1366.66	....	2.55	388.34	1757.55	....	1757.55
	8155.09	32.72	51.01	2677.51	10916.33	195.48	10720.85

SMITH-LEVER STATE FUND

Schedule C

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Administration	1780.69	3.60	....	102.96	1887.25	....	1887.25
Boys' and Girls' Club Work	643.00	6.99	7.85	347.39	1005.23	....	1005.23
Dairying	395.06	....	.25	328.38	723.69	....	723.69
Poultry	100.00	....	3.70	434.22	537.92	....	537.92
Farm Management	210.00	....	.99	229.84	440.83	192.88	247.95
	3128.75	10.59	12.79	1442.79	4594.92	192.88	4402.04

EXPERIMENT STATION DIVISION

Income

State Appropriation		$7,500.00	
Federal Appropriation—			
Hatch Fund	$6,250.00		
Adams Fund	6,250.00		
		12,500.00	
			$20,000.00

Accounts Showing Excess of Receipts Over Expenditures

Dairy Testing	61.02	
	$20,061.02	
Accounts Receivable, Balance	1,141.81	
Fund Balance, October 1, 1918	5,231.99	
		$26,434.82

Accounts Showing Excess of Expenditures Over Receipts October 1, 1918, to June 30, 1919

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Administration	808.27	708.20	963.86	188.27	2748.60	208.33	2540.27
Agronomy	2349.96	2010.13	2644.72	194.29	7199.10	1938.88	5260.22
Animal Diseases	749.97	637.12	71.86	136.96	1595.91	....	1595.91
Chemical	749.97	....	12.00	9.56	771.53	....	771.53

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Contingent	....	....	45.00	....	45.00	....	45.00
Dairy	1855.10	1345.82	1330.50	92.14	4623.56	50.13	4573.43
Poultry	2620.84	950.65	788.83	56.69	4416.91	2852.56	1564.35
Poultry Testing	....	57.92	....	....	57.92	3.25	54.67
Zoology	843.68	4.50	68.58	5.90	922.66	10.50	912.16
	9977.79	5714.34	5005.35	683.71	22381.19	5063.65	17317.54
Fund Balance June 30, 1919							7455.77
Accounts Receivable, Balance June 30th, 1919							1661.51
							$26434.82

GILBERT FARM

Income

Fund Balance October 1, 1918	$18,182.91	
Gilbert Endowment	3,869.76	
Sale Swine	124.70	
		$22,177.37

Departments Showing Excess of Expenditures Over Receipts

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Farm	1512.52	2573.14	4876.24	30.76	8992.66	2750.67	6241.99
Boarding	....	677.65	440.83	....	1118.48	....	1118.48
Poultry	....	523.94	1880.93	....	2404.87	1809.92	594.95
Miscellaneous	....	....	1057.20	....	1057.20	....	1057.20
Traveling Expense	....	....	....	44.20	44.20	....	44.20
Rent of Osborne Farm	....	....	302.70	....	302.70	....	302.70
New Windmill	....	....	410.03	....	410.03	....	410.03
Special Stock Acct.	....	....	7009.07	....	7009.07	3253.81	3735.26
	1512.52	3774.73	15977.00	74.96	21339.21	7814.40	13524.81
Fund Balance June 30, 1919							8652.56
							$22,177.37

Hartford, Conn., August 1st, 1919.

This is to certify that we have audited the books and accounts of the Connecticut Agricultural College for the nine months ending June 30th, 1919, and have found them correct.

WILLIAM P. BAILEY,
JAMES P. TOBIN,
Auditors of Public Accounts.

FOR PERIOD JULY 1, 1919, TO JUNE 30, 1920

TOTAL INCOME ALL DIVISIONS NOT INCLUDING DEPARTMENT RECEIPTS

College Division	$277,176.43		
New Buildings and Improvements	189,357.25		
Extension Division	96,849.46		
Experiment Station Division	27,867.39		
Gilbert Farm Division	22,410.72		
		$613,661.25	
Funds Balance, July 1, 1919		38,662.59	
Accounts Receivable, Balance July 1, 1919		6,095.56	
			$658,419.40

Expenditures Over Receipts All Divisions

College Division	$303,826.57		
New Buildings and Improvements	164,889.56		
Extension Division	85,671.11		
Experiment Station Division	37,160.33		
Gilbert Farm Division	16,511.05		
		$608,058.62	
Funds Balance, June 30, 1920		34,587.45	
Accounts Receivable Balance		12,884.72	
Scholarship Notes Receivable		2,888.61	
			$658,419.40

COLLEGE DIVISION

Income

Appropriations—		
State Maintenance Fund	$100,00.00	
Morrill Fund	50,000.00	
Interest Land Grant Fund	6,750.00	
Hicks Endowment Income	60.00	
Special State Scholarship	4,000.00	
Special Scholarship	10.00	
State Board of Education, Smith-Hughes	14,165.36	
Sheep Distribution, State	10,000.00	
		$184,985.36
New Buildings and Improvements		189,357.25

Other Income

Rent	$16,731.49	
Fees	31,055.06	
Interest	2,720.34	
Dunham Fund, Interest	999.76	
International Egg Laying Competition	349.86	
Miscellaneous Receipts	6.13	
		51,862.64
Insurance—		
Grove Cottage, Dairy Barn and Storrs Hall		40,328.43

Fund Balances July 1, 1919

State Maintenance Fund (Overdraft)	$3,723.15		
Smith-Hughes Fund (Overdraft)	3,424.91		
Hicks Prize		$271.70	
Special Sheep Distribution Fund		10,000.00	
Special Scholarship Fund		75.00	
State Scholarship Fund		2,046.14	
	$7,148.06	$12,392.84	Cr. 5,244.78
Accounts Receivable			4,426.75
			$476,205.21

ACCOUNTS SHOWING EXCESS OF EXPENDITURES OVER RECEIPTS

COLLEGE DIVISION

JULY 1, 1919, TO JUNE 30, 1920

Summary

Administration (Schedule A)	$23,089.43	
Department of Instruction (Schedule B)	125,153.72	
Repairs and Maintenance (Schedule C)	77,854.70	
Supplies and Service to Students (Schedule D)	2,866.78	
Sheep Distribution (Schedule E)	16,910.45	
Contingent (Schedule F)	2,450.00	
Self-Supporting Departments (Schedule G)	9,318.89	
Extraordinary Expenditures (Schedule H)	6,037.59	
		$263,681.56
New Dairy Barn and Silos (Schedule I)		35,145.01
Extension and Experiment Station Payments from Sheep Fund (Schedule J)		5,000.00
New Buildings and Improvements, Legislature 1919 (Schedule K)		164,889.56
		$468,716.13

Fund Balances June 30, 1920

	Dr.	Cr.	
State Fund (Overdraft)	$2.745.00		
Smith-Hughes Fund (Overdraft)	5,601.74		
State Scholarship		$3,167.53	
Special Scholarship		75.00	
Hicks Prize		331.70	
	$8,346.74	$3,574.23	
Less Funds Overdraft June 30, 1920			4,772.51
			$463,943.62
Accounts Receivable Balance			9,372.98
Scholarship Notes Receivable			2,888.61
			$476,205.21

GENERAL ADMINISTRATION EXPENSES IN EXCESS OF RECEIPTS

Schedule A

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Officers' Salaries	9649.92	....	....	....	9649.92	1725.00	7924.92
Office Employees	9855.47	....	....	....	9855.47	2382.80	7472.67
Postage and Office Supplies	....	....	2585.65	....	2585.65	515.94	2069.71
Traveling Expense	....	....	....	1417.91	1417.91	108.00	1309.91
Trustees' Expenses	....	....	....	599.61	599.61	143.00	456.61

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Publicity Committee	300.00	40.69	1540.87	95.45	1977.01	85.88	1891.13
Telephone and Telegraph	655.00	....	2309.59	....	2964.59	1988.86	975.73
Ent. of Guests	....	....	278.47	3.20	281.67	....	281.67
Misc. Expense	....	....	724.64	....	724.64	17.56	707.08
	20460.39	40.69	7439.22	2116.17	30056.47	6967.04	23089.43

DEPARTMENTS OF INSTRUCTION

Schedule B

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Agronomy	6863.67	1460.79	1417.54	84.10	9826.10	212.32	9613.78
Agri. Education	3141.65	....	10.21	23.72	3175.58	145.82	3029.76
Apiculture	1116.65	41.65	529.00	....	1687.30	608.82	1078.48
Bacteriology	4399.98	1372.11	676.98	....	6449.07	228.33	6220.74
Botanical	4283.27	834.19	1023.44	75.00	6215.90	279.20	5936.70
Chemistry	5724.84	112.37	4707.45	32.20	10576.86	1529.78	9047.08
Creamery	1549.94	2913.62	22300.91	39.98	26804.45	19937.01	6867.44
Dairy	1562.46	4769.28	18555.06	305.17	25191.97	16386.82	8805.15
Eng. and History	4694.03	173.76	247.19	45.31	5160.29	....	5160.29
Economics	2187.48	6.71	36.08	....	2230.27	....	2230.27
Farm	3949.86	17543.38	20636.73	191.95	42321.92	29619.88	12702.04
Forestry	1250.00	141.03	317.35	....	1708.38	1256.00	452.38
French	1999.98	141.03	10.28	....	2010.26	....	2010.26
Gardening	2400.00	1400.91	1095.66	....	4896.57	813.06	4083.51
German	500.02	....	2.21	....	502.23	....	502.23
Greenhouse	799.92	1979.47	351.31	....	3130.70	445.03	2685.67
Grounds	1050.00	2415.79	919.54	....	4385.33	106.42	4278.91
Home Economics	5945.32	289.79	4057.76	19.32	10312.19	684.00	9628.19
Library	999.96	741.01	1345.35	....	3086.32	....	3086.32
Math. and Physics	2724.96	919.74	348.79	....	3993.49	82.50	3910.99
Mech. Engineering	2924.94	110.99	1565.22	....	4601.15	63.00	4538.15
Military	....	326.30	331.59	....	657.89	219.73	438.16
Physical Education	2159.96	17.40	420.63	1.78	2599.77	38.61	2561.16
Poultry	4174.92	1956.64	3936.67	169.65	10237.88	2667.76	7570.12
Pomology	2074.98	2080.33	1682.66	21.96	5859.93	3199.93	2660.00
Veterinary Science	650.00	....	....	....	650.00	....	650.00
Zoology	3674.94	164.73	634.09	....	4473.76	5.00	4468.76
Practice House	....	4.25	82.75	....	87.00	33.16	53.84
Registrar's Dept.	883.34	....	....	....	883.34	....	883.34
	73687.07	41776.24	87242.45	1010.14	203715.90	78562.18	125153.72

REPAIRS AND MAINTENANCE

Schedule C

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Engineer and Fireman	....	6114.72	....	....	6114.72	....	6114.72
Fuel and Light	....	....	35665.48	....	35665.48	9308.14	26357.34
Insurance	....	....	6244.76	....	6244.76	47.57	6197.19
Janitor Work and Supplies	....	2189.89	1929.63	....	4119.52	232.95	3886.57
Repairs to Buildings	2116.63	20175.53	24113.98	....	46406.14	11107.26	35298.88
	2116.63	28480.14	67953.85	....	98550.62	20695.92	77854.70

SUPPLIES AND SERVICE TO STUDENTS

Schedule D

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Lectures and Entertainment	....	336.90	1985.77	....	2322.67	2086.68	235.99
Pew Rent	....	....	799.92	....	799.92	....	799.92
Nurse and Medical Service	642.50	293.78	508.29	....	1444.57	7.35	1437.22
Commencement	....	....	393.65	....	393.65	....	393.65
	642.50	630.68	3687.63	....	4960.81	2094.03	2866.78

SPECIAL ACCOUNTS

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Sheep (Schedule E)	....	856.92	18732.04	75.49	19664.45	2754.00	16910.45
Contingent (Schedule F)	....	....	2450.00	....	2450.00	....	2450.00
	....	856.92	21182.04	75.49	22114.45	2754.00	19360.45

SELF-SUPPORTING DEPARTMENTS

Schedule G

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Boarding	....	12759.24	52130.45	....	64889.69	56709.60	8180.09
Book Store	1413.72	1106.63	22566.62	....	25086.97	23952.69	1134.28
Print Shop	....	220.00	54.02	....	274.02	269.50	4.52
	1413.72	14085.87	74751.09	....	90250.68	80931.79	9318.89

EXTRAORDINARY EXPENDITURES

Schedule H

Departments	Supplies $	Travel $	Total $	Receipts $	Balance $
New Furniture for Dormitories	4708.12	....	4708.12	25.10	4683.02
Central Heating Plant	1177.87	....	1177.87	....	1177.87
Apartment for Office Employees	174.00	....	174.00	....	174.00
Compensation	2.70	....	2.70	....	2.70
	6062.69	....	6062.69	25.10	6037.59

DAIRY BARN AND SILOS

Schedule I

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Dairy Barn	1052.00	12204.33	16511.15	....	29767.48	68.31	29699.17
Dairy Barn Silos	....	....	5721.91	....	5721.91	276.07	5445.84
	1052.00	12204.33	22233.06	....	35489.39	344.38	35145.01

PAYMENTS FROM SHEEP FUND

Schedule J

Departments	Supplies $	Travel $	Total $	Receipts $	Balance $
Experiment Station	2000.00	....	2000.00	....	2000.00
Extension	3000.00	....	3000.00	....	3000.00
	5000.00	....	5000.00	....	5000.00

DEPARTMENTS SHOWING EXCESS OF RECEIPTS OVER EXPENDITURES

See Receipts

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $
Competition	4214.52	9528.70	132.08	13875.30	14225.16	349.86 Cr.
Laundry	....	614.88	....	614.88	621.01	6.13 Cr.
Dunham Farm	....	50.00	....	50.00	1049.76	999.76 Cr.
	4214.52	10193.58	132.08	14540.18	15895.93	1355.75

EXPENDITURES

APPROPRIATION BUILDINGS AND IMPROVEMENTS, LEGISLATURE OF 1919

Schedule K

New Dining Hall	$80,456.43	
Infirmary	13,025.35	
Hauschild House, No. 3	10,046.10	
Sewage and Water for New Cottages	739.09	
Architect's Fees	1,912.41	
New Cottages 11, 12, 13 and 14	27,944.55	
Poultry Building	1,573.03	
Equipment for Chemical Laboratory	5,000.00	
Drainage of Valentine Meadow	4,971.47	
New Dining Hall, Sewage and Drainage	198.33	
Grading Walks and Roads, N. D. H. and Infirmary	44.56	
Connection with C. H. P., Dining Hall and Infirmary	1,443.27	
Refrigeration of New Dining Hall	6,212.40	
Furnishings for Infirmary	1,019.34	
New Cottages Contract 15 and 16	10,303.33	
		$164,889.66

DRAWINGS ON COMPTROLLER

See Receipts

Appropriation	Budget	Drawn	Balance
New Dining Hall	$66,600.00	$66,600.00	
Faculty Cottages	62,700.00	51,936.25	$10,763.75
Drainage of Land	6,460.00	6,460.00	
Temporary Chemical Laboratory	10,000.00	10,000.00	
Equipment for Chemical Laboratory	5,000.00	5,000.00	
Poultry Plant	3,075.00	3,075.00	
Infirmary	8,320.00	8,320.00	
Additional Appropriation on Dining Hall	37,966.00	37,966.00	
	$200,121.00	$189,357.25	$10,763.75

NEW BUILDINGS AND IMPROVEMENTS APPROPRIATION

New Dining Hall and Infirmary—		
New Dining Hall	$66,600.00	
Infirmary	8,320.00	
Temporary Chemical Laboratory	10,000.00	
Addition by Board of Control	37,966.00	
		$122,886.00
Expended—		
New Dining Hall Contract	$80,456.43	
Architect Fees	1,912.41	
Infirmary Contract	13,025.35	
Grading, Walks and Roads	44.56	
Connection with Central Heating Plant	1,443.27	
Refrigeration	6,212.40	
Infirmary Furnishings	1,019.34	
Sewage and Drainage	198.33	
		104,312.09
Available Balance		$18,573.91
Faculty Cottages—		
Appropriation		$62,700.00
Expended—		
Hauschild House, No. 3	$12,046.10	
Sewage and Water	739.09	
Cottages 11, 12, 13 and 14	27,944.55	
Cottages 15 and 16	10,303.33	
		51,033.07
Available Balance		$11,666.93
Poultry Buildings—		
Appropriation		$3,075.00
Expended		1,573.03
Available Balance		$1,501 97
Drainage of Land—		
Appropriation		$6,460.00
Expended		4,971.47
Available Balance		$1,488.53
Equipment of Chemical Laboratory—		
Appropriation		$5,000.00
Expended		5,000.00
Expended from Insurance—		
Grove Cottage and Dairy Barn		$40,328.43
Expended—		
Dairy Barn	$29,699.17	
Dairy Barn Silos	5,445.84	
		35,145.01
Available Balance		$5,183.42

STATEMENT SHOWING ACCOUNTING OF TOTAL FUNDS

Fund Balances July 1, 1919

State Maintenance Fund (Overdraft)	$3,723.15	
Extension Fund Cr.		$17,309.48
Experiment Station Fund Cr.		7,455.77
Gilbert Fund Cr.		8,652.56
Smith-Hughes Fund Dr.	3,424.91	

Hicks Prize Fund Cr		271.70	
Special Scholarship Fund Cr		75.00	
State Scholarship Fund Cr		2,046.14	
Special Sheep Distribution Fund		10,000.00	
	$7,148.06	$45,810.65	$38,662.59
Accounted for as follows—			
Cash in Vault	$3,208.53		
Less Student Bank	718.37		
		2,491.16	
Hartford Trust Co		2,418.73	
Willimantic Trust Co		3,944.48	
Windham National Bank		15,000.00	
Middletown National Bank		14,808.22	
			$38,662.59

Fund Balance June 30, 1920

State Maintenance Fund (Overdraft)	$2,745.00		
Extension Fund Cr		$26,583.42	
Experiment Fund Dr	2,585.69		
Gilbert Fund Cr		14,552.23	
Hicks Prize Fund		331.70	
State Scholarship Fund Cr		3,167.53	
Smith-Hughes Fund Dr	5,601.74		
Special Prize Fund Cr		810.00	
Special Scholarship Fund Cr		75.00	
	$10,932.43	$45,519.88	
			$34,587.45
Accounted for as follows—			
Cash in Vault	$2,187.42		
Less Student Bank	1,423.88		
		$763.54	
Hartford Connecticut Trust Co		4,129.36	
Middletown National Bank		21,522.38	
Willimantic Trust Co		8,172.17	
			$34,587.45

EXTENSION SERVICE DIVISION

Income

Appropriations—			
Legislature 1919, State	$67,150.00		
Board of Control for Marketing	3,650.00		
Smith Lever Act Federal	16,054.52		
Federal Extension Fund	3,492.99		
		$90,347.51	
Income Other Sources—			
Sperry & Barnes for Pig Club Prizes	$800.00		
Miriam Baker (Boys' and Girls' Club)	10.00		
Connecticut Agricultural College Sheep Fund	3,000.00		
Poultry Testing Work	231.63		
From Salary Advance	2,460.32		
		6,501.95	
Fund Balances, July 1, 1919	$17,309.48		
Accounts Receivable, Balance July 1, 1919	7.30		
		17,316.78	
			$114,166.24

SUMMARY

Expenditures Over Receipts

State Fund (Schedule A)	$56,550.52		
Smith-Lever State (Schedule B)	6,054.52		
Smith-Lever Federal (Schedule C)	16,075.28		
Federal Extensive Fund (Schedule D)	3,498.59		
Federal State Fund (Schedule E)	3,492.20		
		$85,671.11	
Extension General Fund, Balance June 30, 1920	$26,583.42		
Extension Prize Fund, Balance June 30, 1920	810.00		
Accounts Receivable, Balance June 30, 1920	1,101.71		
		28,495.13	
			$114,166.24

EXTENSION SERVICE DIVISION
STATE FUND
Schedule A

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Administration, Special	....	....	3489.00	....	3489.00	....	3489.00
Administration	2889.20	197.51	507.72	563.57	4158.00	14.00	4144.00
Agr'l Editor	4154.42	21.16	1993.44	98.17	6267.19	14.16	6253.03
Agronomy	60.00	....	21.75	40.26	122.01	100.00	22.01
Apiculture	1207.92	....	108.31	299.23	1615.46	750.00	865.46
Boys' and Girls' Clubs	692.68	71.35	840.43	873.60	2478.06	124.96	2353.10
Contingent	....	814.89	6289.56	2965.78	10070.23	3643.31	6426.92
County Agents	1132.87	....	939.45	615.84	2688.16	36.72	2651.44
Dairying	991.43	4.03	137.38	922.73	2055.57	121.13	1934.44
Fair Exhibits	188.50	675.75	900.59	131.67	1896.51	426.41	1470.10
Farmers' Institute Ext. Schools	490.00	....	93.89	170.42	754.31	....	754.31
Farm Management	848.67	....	149.18	1433.56	2431.41	36.55	2394.86
Home Economics	2761.94	4.40	309.83	1415.76	4491.93	72.00	4419.93
Horticulture	187.50	....	5.00	129.51	322.01	4.42	317.59
Horticulture Fruit	437.50	.20	....	....	437.70	....	437.70
Marketing	7676.36	719.72	1545.99	1177.33	11119.40	15.03	11104.37
Poultry	1735.00	71.57	737.42	1617.71	4161.70	19.40	4142.30
Sheep	2019.49	.25	116.47	1236.65	3372.86	2.90	3369.96
	27473.48	2580.83	18185.41	13691.79	61931.51	5389.99	56550.52

EXTENSION SERVICE DIVISION
SMITH-LEVER FEDERAL FUND
Schedule B

Departments	Salaries $	Labor $	Supplies $	Travel $	Total $	Receipts $	Balance $
Administration	2991.52	....	1.95	198.05	3191.52	....	3191.52
Agronomy	1250.34	....	.65	549.77	1800.76	....	1800.76
Boys' and Girls' Clubs	682.00	....	3.00	215.00	900.00	....	900.00
County Agents	3441.67	....	....	260.85	3702.52	602.52	3100.00
Dairy	500.00	....	....	....	500.00	....	500.00
Farm Management	1740.83	....	1.55	357.62	2100.00	....	2100.00

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Home Economics....	1632.00	....	....	30.00	1662.00	....	1662.00
Poultry	2150.00	....	....	350.00	2500.00	....	2500.00
Sheep	103.51	....	1.05	216.44	321.00	....	321.00
	14491.87	....	8.20	2177.73	16677.80	602.52	16075.28

SMITH-LEVER FUND

Schedule C

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Boys' and Girls' Clubs	1288.25	....	2.90	118.85	1410.00	....	1410.00
County Agents......	3589.78	....	1.15	309.07	3900.00	....	3900.00
Home Economics...	744.52	....	....	....	744.52	....	744.52
	5622.55	....	4.05	427.92	6054.52	....	6054.52

FEDERAL EXTENSION STATE OFFSET

Schedule D

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Boys' and Girls' Clubs	3492.20	....	....	....	3492.20	....	3492.20

FEDERAL EXTENSION FUND

Schedule E

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Home Economics....	3519.59	....	....	....	3519.59	21.00	3498.59

EXPERIMENT STATION DIVISION

Income

Appropriation—			
Legislature 1919	$10,625.00		
Hatch Act (Federal).............................	7,500.00		
Adams Act (Federal).............................	7,500.00		
College Sheep Fund (State)........................	2,000.00		
		$27,625.00	
Accounts Showing Excess of Receipts over Expenditures—			
Dairy Testing	$242.39	242.39	
		$27,867.39	
Fund Balances July 1, 1919.........................		7,455.77	
Accounts Receivable Balance.......................		1,661.51	
			$36,984.67

Expenditures

Department Expenditures over Receipts......................	$37,160.33	
Accounts Receivable, Balance June 30, 1920..................	2,410.03	
	$39,570.36	
Less Fund Overdraft June 30, 1920.........................	2,585.69	
		$36,984.67

Accounts Showing Excess of Expenditures over Receipts—

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Administration, Special	....	....	860.00	....	860.00	....	860.00
Administration	899.94	993.70	468.26	267.35	2629.25	9.90	2619.35
Agronomy	4179.11	4590.62	3127.81	265.82	12163.36	1540.49	10622.87
Animal Diseases	999.96	1054.45	456.11	108.42	2618.94	....	2618.94
Chemistry	1099.98	....	15.00	26.80	1141.78	....	1141.78
Dairy	3762.46	2123.32	3133.35	262.33	9281.46	252.45	9029.01
Contingent	....	....	20.00	....	20.00	....	20.00
Poultry	3002.89	2723.36	4932.73	33.56	10692.54	3929.47	6763.07
Zoology	1041.74	144.00	105.58	....	1291.32	154.00	1137.32
Sheep	633.28	497.78	1147.89	85.04	2363.99	16.00	2347.99
	15619.36	12127.23	13406.73	1049.32	43062.64	5902.31	37160.33

Accounts Showing Excess of Receipts over Expenditures—

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Dairy Testing	....	178.71	287.67	5099.17	6510.40	6752.79	242.39

GILBERT FARM

Income

Dividend Gilbert Endowment	$18,000.00	
Department Receipts over Expenditures	4,410.72	
Fund Balance, July 1, 1919	8,652.56	
		$31,063.28

Departments Showing Excess of Receipts over Expenditures—

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Poultry	....	556.62	4397.57	....	4954.19	5781.91	827.72
Insurance	....	....	....	....	....	450.00	450.00
Sale of Stock	....	....	....	....	....	3133.00	3133.00
		556.62	4397.57	....	4954.19	9364.91	4410.72

Expenditures

Department Expenditures over Receipts	$16,511.05	
Fund Balance, June 30, 1920	14,552.23	
		$31,063.28

Departments Showing Excess of Expenditures over Receipts—

Departments	Salaries	Labor	Supplies	Travel	Total	Receipts	Balance
	$	$	$	$	$	$	$
Boarding	1150.00	....	583.50	....	1688.50	....	1688.50
Farm	2000.00	3470.60	12061.35	137.97	17669.92	5160.96	12508.96
Miscellaneous	....	....	1907.09	....	1907.09	....	1907.09
Rent of Osborn Farm	....	....	400.00	....	400.00	....	400.00
Repairs to Osborn Farm	....	....	6.50	....	6.50	....	6.50
	3105.00	3470.60	14958.44	137.97	21672.01	5160.96	16511.05

SPECIAL FUND FOR SHEEP DISTRIBUTION

Receipts

1918-1919—			
Appropriation	$10,000.00		
1919-1920—			
Appropriation	10,000.00		
		$20,000.00	
Sale of Stock, etc.		2,754.00	
		$22,754.00	
Chargeable to 1920-1921 Appropriation		1,910.45	
			$24,664.45

Expenditures

1919-1920—			
Purchase of Sears Farm (for Distribution Purposes)		$11,000.00	
Stock		3,125.00	
New Fencing		1,163.72	
Labor		856.92	
Travel		75.49	
Supplies, Feed, Transportation, Freight, etc.		3,443.32	
		$19,664.45	
Storrs Experiment Station—			
Salaries	$633.28		
Labor	497.78		
Purchase of Stock Feed, Supplies, etc.	783.90		
Travel	85.04		
		2,000.00	
Extension Service—			
Salaries	$2,019.49		
Labor	.25		
Supplies	116.47		
Travel	863.79		
		3,000.00	
			$24,644.45

SMITH-HUGHES APPROPRIATION FOR TEACHER TRAINING IN AGRICULTURE AND HOME ECONOMICS

Receipts

1918-1919—			
State Board of Education, Teacher Training in Home Economics	$8,515.05		
State Board of Education, Teacher Training in Agriculture	3,406.02		
		$11,921.07	
1919-1920—			
State Board of Education, Teacher Training in Home Economics	$4,940.37		
Due June 30, 1920, from State Board of Education for Teacher Training in Home Economics	6,007.55		
State Board of Education, Teacher Training in Agriculture	1,483.33		
Due June 30, 1920, from State Board of Education for Teacher Training in Agriculture	2,895.83		
		15,327.08	
			$27,248.15

Expenditures

1918-1919—			
Salaries—Teacher Training in Home Economics....	$8,027.95		
Supplies	487.10		
Salaries—Teacher Training in Agriculture.........	3,276.85		
Clerical Hire	129.17		
		$11,921.07	
1919-1920—			
Salaries—Teacher Training in Home Economics....	$10,947.92		
Salaries—Teacher Training in Agriculture.........	4,379.16		
		15,327.08	
			$27,248.15

STATE SCHOLARSHIP FUND

Receipts

1917-1918—		
Appropriation, Legislature 1917...................	$4,000.00	
Interest 1917	87.74	
1919-1920—		
Appropriation, Legislature 1919...................	4,000.00	
Notes Paid	196.39	
1920-1921—		
Notes Paid	251.34	
		$8,535.47

Expenditures

1917-1918—					
Scholarships	10	@	$50.00	500.00	
	3	@	25.00	75.00	
1918-1919—					
Scholarships	16	@	50.00	800.00	
	18	@	33.33	599.94	
	3	@	25.00	75.00	
	1	@	16.66	16.66	
1919-1920—					
Scholarships	58	@	50.00	2,900.00	
	7	@	25.00	175.00	
1920-1921 (First Semester)—					
Scholarships	15	@	50.00	750.00	
	2	@	25.00	50.00	
					5.941.60
Balance of Fund November 11, 1920.........					2,593.87
					$8.535.47

Total Scholarships Issued..................	99	@	50.00
	1	@	16.66
	18	@	33.33
	15	@	25.00
Total	133		

Total number of Scholarships in force for students now in College, 89.

Hartford, Conn., Dec. 6th, 1920.

This is to certify that we have audited the books and accounts of the Connecticut Agricultural College for the fiscal year ending June 30th. 1920, and have found them correct.

WILLIAM P. BAILEY,
LEWIS W. PHELPS,
Auditors of Public Accounts.

INSURANCE ON BUILDINGS AND CONTENTS AT STORRS

Identification	Replacement Value of Bldgs.	Ins. on Bldgs.	Value of Contents	Ins. on Contents	T't'l Ins. on Bldgs. and Contents
1. Administration	$74,800	$40,600	$82,838	$58,000	$98,600
2. Apiculture Barn	2,860	1,200	1,266	900	2,100
3. Apiculture House	8,500	5,300	......	......	5,300
4. Armory	156,500	30,000	8,162	4,000	34,000
5. Blake House	7,560	3,700	......	......	3,700
6. Bull Barn, Concrete	4,160	2,500	2,900	2,000	4,500
7. Carpenter Shop	2,150	1,100	2,905	2,000	3,100
8. Central Heating Plant	27,000	5,000	......	......	5,000
9. Cottage No. 1	13,970	8,300	......	......	8,300
10. Cottage No. 3	19,690	12,800	......	......	12,800
11. Cottage No. 4	13,250	8,600	......	......	8,600
12. Cottage No. 5	19,690	12,800	......	......	12,800
13. Cottage No. 6	15,000	9,700	......	......	9,700
14. Cottage No. 7	15,000	9,700	......	......	9,700
15. Cottage No. 8	15,000	9,700	......	......	9,700
16. Cottage No. 9	12,000	8,200	......	......	8,200
17. Cottage No. 10	12,000	8,200	......	......	8,200
18. Cottage No. 11	12,000	8,200	......	......	8,200
19. Cottage No. 12	12,000	8,200	......	......	8,200
20. Cottage No. 13	13,250	9,100	......	......	9,100
21. Cottage No. 14	12,000	8,200	......	......	8,200
22. Cottage No. 15	17,520	12,000	......	......	12,000
23. Cottage No. 16	17,520	12,000	......	......	12,000
24. Cottage No. 17	12,000	8,200	......	......	8,200
25. Cottage No. 18	17,320	11,800	1,700	1,200	13,000
26. Cottage No. 19	17,320	11,800	......	......	11,800
27. Cottage No. 21	12,000	8,200	......	......	8,200
28. Cottage No. 22	17,320	11,800	......	......	11,800
29. Cottage No. 23	17,320	11,800	......	......	11,800
30. Dairy Barn and Silos	56,930	25,000	17,400	12,000	37,000
31. Dairy Building	62,400	40,200	24,800	17,300	57,500
32. Dining Hall	130,000	25,000	18,000	5,000	30,000
33. Dining Hall Emp. Cottage	10,100	6,900	1,200	800	7,700
34. Experiment Station Office.	6,430	3,700	2,390	1,500	5,200
35. Farm House	8,800	2,000	350	250	2,250
36. Farm Horse Barn	4,900	2,700	4,400	3,100	5,800
37. Fitts House	9,000	5,400	......	......	5,400
38. Greenhouses and Florist's Cottage	60,500	37,100	2,460	1,700	38,800
39. Gulley House	12,000	3,800	......	......	3,800
40. Hauschild House No. 1	9,350	5,600	......	......	5,600
41. Hauschild House No. 2	11,340	7,600	......	......	7,600
42. Hauschild House No. 3	15,000	10,200	1,800	1,300	10,200
43. Hauschild Barn	1,000	700	800	600	1,300
44. Horse Barn	36,260	23,700	8,875	6,000	29,700
45. Horse Barn Annex	4,600	2,800	3,650	2,600	5,400
46. Horticultural Barn	600	......	1,231	900	900
47. Horticultural Building	65,600	39,900	10,790	7,500	47,400
48. Infirmary	14,520	9,800	1,238	900	10,700
49. Jacobson Barn	10,760	6,500	10,703	7,500	14,000
50. Jacobson House	9,000	4,100	......	......	4,100

Identification	Replacement Value of Bldgs.	Ins. on Bldgs.	Value of Contents	Ins. on Contents	T't'l Ins on Bldgs. and Contents
51. Koons Hall	194,000	30,000	8.040	2,000	32,000
52. Machinery Building	36,100	10,000	8.792	3,500	13,500
53. Manter House	5,500	3,100	......	......	3,100
54. Mechanic Arts	45,100	27,900	7,975	5.600	33,500
55. Mueller Barn	1,100	800	400	300	1,100
56. Mueller House No. 1	1,550	1,100	......	......	1,100
57. Mueller House No. 2	5,000	3,500	......	......	3.500
58. Patterson House	10,800	7,300	......	......	7,300
59. Phelps House	14,100	9,000	......	......	9,000
60. Piggery	6,740	4,500	2,154	1,200	5,700
61. Poultry Building	57,420	39,600	4,113	2,900	42,500
62. Poultry Feed House	4,700	3,000	1,600	1,000	4.000
63. Rosebrooks Barn	8,750	4,900	3,325	2,400	7,300
64. Rosebrooks House	8,450	4,400	......	......	4,400
65. Sears Barn	6.820	3,300	2,500	1,800	5,100
66. Sears House	12,500	6.700	......	......	6.700
67. Storrs Hall	189,000	75,000	10,760	3,000	78,000
68. Supt's Bldgs, Office	1,820	1,100	3,124	2,200	3,300
69. Upham House	2,850	1,200	......	......	1,200
70. Valentine Cottage	4,700	2,500	......	......	2,500
71. Valentine House	23,000	10,900	1,985	1,400	12,300
72. Whitney Barn	3,280	1,500	1,933	1,400	2,900
73. Whitney Hall	43,500	23,300	4,365	2,700	26,000
74. Whitney House	11,500	5,400	......	......	5,400
75. Gulley Barn	960	......	......	......	......
76. Poultry Houses (50)	5,000	......	......	......	......
77. Valentine Corn Crib	600	......	......	......	......
78. Bact. Shed	900	......	......	......	......
79. Lumber Shed near C. H. P.	700	......	......	......	......
80. Farm Wagon Shed	300	......	......	......	......
81. Ice House	600	......	......	......	......
82. Garage, Gurleyville Road.	300	......	......	......	......
83. Garage, r. Cottage No. 6.	1,000	......	......	......	......
84. Garage, r. Cottage No. 14	150	......	......	......	......
85. Garage, r. Cottage No. 14.	1,000	......	......	......	......
86. Garage, r. Cottage No. 8.	150	......	......	......	......
87. Garage, r. Phelps Cottage.	600	......	......	......	......
88. Garage, r. Fitts House	75	......	......	......	......
89. Garage, r. Hauschild Cottage No. 2	200	......	......	......	......
90. Garage, r. Hauschild Cottage No. 3	100	......	......	......	......
91. Fireman's Shanty	300	......	......	......	......
92. Woodman's Shanty	100	......	......	......	......
93. New Poultry Plant, Poultry Houses	9,000	2,400	4,000	1,000	3,400
94. Jacobson Shed	300	......	......	......	......
95. Farm Corn Crib	150	......	......	......	......
96. Exp. Station Store House.	800	......	......	......	......
97. Blacksmith Shop*	......	200	......	......	200
98. Flaherty Barn*	......	......	1,800	1,200	1,200
99. Gillette Barn*	......	......	2,500	1.800	1,800
Totals	$1,857,355	$844,000	$277,424	$171,150	$1,015.150

*Not owned by College.

APPOINTMENTS AND RESIGNATIONS

DURING TWO YEARS ENDING NOVEMBER 1, 1920

COLLEGE DIVISION

Appointments:—

Ackerman, Walter T., Instructor in Agricultural Engineering.
Bayley, Julia C., Instructor in Chemistry.
Barker, Helen, Instructor in Home Economics.
Boyers, Captain Robert E., Commandant.
Crandall, L. B., Specialist in Beekeeping.
Dodge, Richard E., Dean of the School of Agriculture.
Denlinger, Henry, Assistant Professor in English.
Dreesner, A. Harry, Instructor in Mechanical Engineering.
Driscoll, Mary A., Resident Nurse.
Dean, Stella M., Instructor in Home Economics.
Dixon, Captain Henry S., Assistant Professor of Military Science.
Dorsey, Henry, Assistant Agronomist.
Davis, I. G., Professor of Agricultural Economics.
Eaton, Theodore H., Dean Teacher Training.
Ferris, Captain B. G., Commandant.
Freedman, Sgt. Joseph, Instructor in Military Science.
Fisher, R. C., Instructor in Dairying.
Gumbart, E. H., Associate Professor of Economics.
Guyer, Roy E., Professor of Physical Education.
Gentry, C. B., Dean Teacher Training.
Knipe, Frederick W., Instructor Agricultural Engineering.
Mason, Edith, Instructor in Home Economics.
Miller, Frank P., Farm Foreman.
Manchester, A. W., Professor of Farm Management.
Piper, Anna S., Resident Nurse.
Strother, Charles R., Sgt. Instructor in Military Science.
Snow, Morton E., Chief Accountant.
Schwartz, Ross W., Assistant Coach.
Skinner, A. G., Instructor in Animal Husbandry
Taft, Viola Z., Manager of Boarding Club.
Vining, Roscoe H., Professor of English.

Resignations:—

Ackerman, Walter T., Instructor in Agricultural Engineering.
Abel, Max F., Instructor in Farm Management.
Alger, Harry B., Instructor in Dairy Husbandry.
Arner, William, Lieut. Instructor in Military Science.
Barker, Helen, Instructor in Home Economics.
Bishop, Helen, Instructor in Home Economics.
Barlow, Spencer W., Assistant Physical Education.
Brown, Douglas E., Instructor in Military Science.

Brown, Herbert R., Instructor in Military Science.
Brown, Leonard T., Instructor in Military Science.
Cranston, Claude E., Captain, Commandant.
Campbell, Glenn H., Publicity Editor.
Driscoll, Mary A., Resident Nurse.
Eaton, Theodore H., Dean Teacher Training.
Flynn, Lt. Col. William F., Commandant.
Ferris, Captain Benj. G., Commandant.
Freedman, Sgt. Joseph, Instructor in Military Science.
Gault, Pierre, Instructor in French.
Hays, Herbert M., Instructor in English.
Helmick, B. C., Instructor in Agronomy.
Kuelling, John A., Instructor in Dairying.
Klinck, Merle S., Instructor in Farm Machinery.
Nesbitt, Harry, Captain, Instructor in Military Science.
Price, Hugh B., Instructor in Agricultural Economics.
Smith, Guy C., Professor Agricultural Economics.
Wallace, Anna M., Instructor in English.
Watson, Lloyd R., Specialist in Beekeeping.

EXTENSION DIVISION

Appointments: Specialists:—

Allen, W. H., Assistant Extension Poultryman.
Begg, Robert E., Extension Sheep Specialist.
Crandall, L. B., Specialist in Beekeeping.
Darrow, W. H., Assistant Marketing Agent.
Deming, Mary L., Extension Clothing Specialist.
Owens, J. Stanley, Extension Agronomist.

COUNTY AGENTS AND ASSISTANTS

Appointments:—

Barlow, Spencer W., County Club Leader.
Barrett, Rollin H., Assistant County Agricultural Agent.
Birdsey, Bertha T., Home Demonstration Agent.
Blodgett, Mary C., Home Demonstration Agent.
Brundage, Harold A., County Club Leader.
Butters, Marion E., Home Demonstration Agent.
Davis, Arthur G., County Agricultural Agent.
Davis, Frank L., County Agricultural Agent.
Dole, Sumner A., County Agricultural Agent.
Gifford, Laura R., Home Demonstration Agent.
Greer, Alexander W., County Club Leader.
Hills, Mrs. Helen R., Home Demonstration Agent.
Huckel, B. Eugenie, Home Demonstration Agent.
James, Raymond T., County Club Leader.
Johnson, Harold F., County Agricultural Agent.

Marsland, Walter S., County Agricultural Agent.
Meade, Mrs. Zoe F., Demonstration Agent.
Metcalfe, Jeanette E., Home Demonstration Agent.
Monroe, Ellis, Assistant Marketing Agent.
Moss, Eleanor S., Home Demonstration Agent.
Robinson, Margaret L., Home Demonstration Agent.
Southwick, Benj. G., County Agricultural Agent.
Stratton, Gladys E., Home Demonstration Agent.
Trabue, Elsie, Assistant State Club Leader.
Tucker, Ernest E., County Agricultural Agent.
Wooding, M. Elizabeth, Home Demonstration Agent.

Resignations: Specialists:—

Dorsey, Henry, Extension Agronomist.
Eaton, Theodore H., Dean Teacher Training.
Hollister, Sherman P., Extension Pomologist.
Rhea, William A., Extension Dairyman.
Skinner, A. G., Extension Sheep Specialist.
Smith, Guy C., Field Agent in Marketing.
Sullins, Dee G., Extension Swine Specialist.
Watson, Lloyd R., Extension Bee Specialist.

Resignations: County Agents and Assistants:—

Barlow, Spencer W., County Club Leader.
Barrett, Rollin H., Assistant County Agricultural Agent.
Birdsey, Bertha T., Home Demonstration Agent.
Blodgett, Mary C., Home Demonstration Agent.
Bolan, Helen, Assistant State Club Leader.
Bronson, Emily, Home Demonstration Agent.
Brundage, Harold A., County Club Leader.
Butters, Marion E., Home Demonstration Agent.
Chapman, Frederick S., County Club Leader.
Costello, Margaret A., Home Demonstration Agent.
Dickenson, Marion E., Home Demonstration Agent.
Embleton, Charlotte, Home Demonstration Agent.
Gifford, John E., County Agricultural Agent.
Green, Gladys B., Home Demonstration Agent.
Greer, Alexander W., County Club Leader.
Hallock, Bertha A., County Club Leader.
Harvey, Lester F., County Agricultural Agent.
Hayes, Maud E., Home Demonstration Agent at Large.
Hills, Mrs. Helen R., Home Demonstration Agent.
Huckel, B. Eugenie, Home Demonstration Agent.
Ketcham, Clara E., Home Demonstration Agent.
Lovsnes, Marie, Home Demonstration Agent.
Marsland, Walter S., County Agricultural Agent.
Meade, Mrs. Zoe F., Home Demonstration Agent.

State of Connecticut
PUBLIC DOCUMENT No. 24

Forty-fourth Annual Report

OF

The Connecticut Agricultural Experiment Station

Being the annual report for the year ended October 31

1920

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THE BOARD OF CONTROL.

PRESS OF
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CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF

October 31, 1920.

BOARD OF CONTROL.

His Excellency, Marcus H. Holcomb, *ex-officio*, *President*.

James H. Webb, *Vice President*	Hamden
George A. Hopson, *Secretary*	New Haven
E. H. Jenkins, *Director and Treasurer*	New Haven
Joseph W. Alsop	Avon
Charles R. Treat	Orange
Elijah Rogers	Southington
William H. Hall	South Willington

STAFF.

Administration.	E. H. Jenkins, Ph.D., *Director and Treasurer.*
	Miss V. E. Cole, *Librarian and Stenographer.*
	Miss L. M. Brautlecht, *Bookkeeper and Stenographer.*
	William Veitch, *In charge of Buildings and Grounds.*
Chemistry.	
Analytical Laboratory.	E. Monroe Bailey, Ph.D., *Chemist in Charge.*
	R. E. Andrew, M.A. C. E. Shepard, H. D. Edmond, B.S., Owen L. Nolan, } *Assistant Chemists.*
	Frank Sheldon, *Laboratory Assistant.*
	V. L. Churchill, *Sampling Agent.*
	Miss A. H. Moss, *Clerk.*
Protein Research.	T. B. Osborne, Ph.D., D.Sc., *Chemist in Charge.*
Botany.	G. P. Clinton, Sc.D., *Botanist.*
	E. M. Stoddard, B.S., *Assistant Botanist.*
	Miss Florence A. McCormick, Ph.D., *Scientific Assistant.*
	G. E. Graham, *General Assistant.*
	Mrs. L. D. Kelsey, *Stenographer.*
Entomology.	W. E. Britton, Ph.D., *Entomologist; State Entomologist.*
	B. H. Walden, B.Agr., John T. Ashworth, M. P. Zappe, B.S., Philip Garman, Ph.D., } *Assistant Entomologists.*
	Samuel T. Sealy, *Deputy in Charge of Mosquito Control.*
	Miss Gladys M. Finley, *Stenographer.*
Forestry.	Walter O. Filley, *Forester, also State Forester and State Forest Fire Warden.*
	A. E. Moss, M.F., *Assistant State and Station Forester.*
	H. W. Hicock, M.F., *Assistant Forester.*
	Miss Pauline A. Merchant, *Stenographer.*
Plant Breeding.	Donald F. Jones, S.D., *Plant Breeder.*
	C. D. Hubbell, *Assistant.*
Vegetable Growing.	————

Report of the Board of Control
OF
THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

To His Excellency, Marcus H. Holcomb, Governor of Connecticut:

As required by law, the Board of Control of the Connecticut Agricultural Experiment Station herewith respectfully presents its report for the year ending October 31, 1920.

CHANGES IN THE STATION STAFF.

Miss Etta L. Avery, who had rendered efficient service for nine years as stenographer in the forestry department, died on March 8, 1920.

Michael D'Esopo, assistant chemist, resigned December 1, 1919, to accept an engagement elsewhere.

To fill vacancies in the staff of the chemical department, R. E. Andrew, M.A., began his duties on November 10, 1919, and Owen Nolan on April 1, 1920.

John T. Ashworth succeeded I. W. Davis as deputy in charge of gipsy moth work, on June 1, 1920.

K. F. Chamberlain, assistant in entomology, resigned March 1, 1920.

Samuel T. Sealy was appointed deputy in charge of mosquito work in April of this year.

W. C. Pelton, in charge of vegetable work, resigned May 1, 1920, to accept an assistant professorship in Pennsylvania State College.

A brief summary of the work of the year follows:

THE BOTANICAL DEPARTMENT.

Dr. Clinton in Charge.

An extensive study of the life history of the rusts, Petrie dish infections with rusts, as well as a special study of the pine blister rust, are being carried on by Dr. Clinton with the assistance of Miss McCormick.

Dr. Clinton also continues his study of peach yellows.

During the year a disease survey of tobacco has been prosecuted in coöperation with the Extension Department of the Conn. Agricultural College and the Hartford County Farm Bureau; and for the purpose a temporary summer laboratory for the Station's use was established through the courtesy of the Hartford County Farm Bureau at its headquarters in Hartford. A report of this survey has been prepared.

Special studies of the black rot of tobacco (*Thielavia*) are being carried on by Miss McCormick.

In the field, an experiment on the merits of spraying *versus* dusting for control of the insects and fungi attacking apples has been carried on by Mr. Stoddard of this department, in coöperation with the entomologist.

Other spraying tests on apples and peaches have been conducted by Dr. Clinton and Mr. Stoddard.

The tests of the effect of different fertilizers on the prevalence of fungus troubles are continued.

Work on the improvement of the quality of sweet corn seed by the prevention of disease and by improvement in curing has been carried on under the supervision of Mr. Stoddard.

Four hundred and sixty-three samples of field and garden seeds have been tested for farmers and dealers, chiefly by Mr. Graham. Several hundred samples of sweet corn seed have also been tested in the course of our experiments.

The special publications of the department have been: Report of the Botanist, Bulletin 222, of 86 pp. and 24 plates; Treatment of Apple Trees Girdled by Mice, by E. M. Stoddard, Bulletin of Immediate Information No. 10, 8 pp.

The Chemical Department.

Dr. Bailey in Charge.

Some time has been given to the study of improved methods, especially for the determination of caffein. But the larger share of the time of this department has been taken up with the work of chemical analysis. The testing of samples for the Dairy and Food Commissioner has required much more work than ever before.

Seven hundred and sixty-four samples of fodder materials and field crops, over six hundred samples of fertilizers, and about twenty-four hundred samples of foods, drugs and miscellaneous articles have been analyzed and the results prepared for publication—the latter a matter involving much labor. Twenty-four hundred and sixty-two pieces of Babcock glassware have been tested and either certified correct or rejected. About two per cent. were found to be inaccurate.

Expert testimony in court has been required in 16 cases. The department has coöperated with the Police and Health authorities in a number of other cases, notably in Hartford in December, 1919, which was the first of a series of prosecutions growing out of the distribution, sale and consumption of liquor containing wood alcohol, by which many persons were poisoned.

This department has issued the annual report on Fertilizers, Bulletin 217; annual report on Food Products and Drugs, Part 1, Bulletin 219; Part 2 (Diabetic Foods), Bulletin 220; annual report on Feeding Stuffs, Bulletin 221.

Dr. Bailey continues as Expert on Diabetic Foods for the American Medical Association, a referee of the Association of Official Agricultural Chemists, and State Chemist.

THE ENTOMOLOGICAL DEPARTMENT.

Dr. Britton in Charge.

On account of the Federal quarantine, the importation of foreign nursery stock has greatly decreased, only seventeen shipments requiring the entomologist's inspection, of which eleven were infested with insects or fungi.

Ninety-five nurseries were officially inspected and sixty-five orchards and gardens examined.

Four hundred and eighty apiaries, containing about 2,250 colonies, were also inspected, to eliminate foul brood.

In coöperation with the Federal Bureau of Entomology the work of controlling the gipsy moth has been actively prosecuted. The number of infestations found and the number of egg clusters destroyed have been about the same as last year. For this department a new automobile truck power sprayer and two new Ford trucks have been purchased. A Ford touring car has also been acquired by exchange.

An experiment on the efficiency of dusting compared with spraying to control insects and fungi has been carried out in the apple orchard of Mr. W. F. Platt in Milford. About 116 large trees were included and all the fruit from certain trees in each plot was examined and scored.

Spraying tests to control the potato aphid have also been completed.

Mr. Zappe has studied the life history of a new species of sawfly on Austrian pine and has made preliminary studies of the hatching and development of the apple red bug and apple leaf-hopper.

Dr. Garman has studied the life history of the bulb mite and measures of control, and the results are now ready to publish. He has found in six widely separated Connecticut orchards the European plum mite, a species not hitherto known to occur in this country, but since reported in New Jersey and Pennsylvania. The damage done by it is more severe and becomes apparent earlier in the season than that of other orchard mites. Spraying and dusting tests indicate that summer treatment is nearly futile, but where commercial lime-sulphur was used as a dormant spray the injury was much less severe.

Dr. Garman is also studying the life history of the spittle insects attacking grasses, and is also preparing two papers for the Natural History Survey of the State, one on the Dragon Flies, and the other on the Mites of Connecticut.

Mr. Walden has collected an important series of leaf-hoppers from different host plants.

Dr. Britton has nearly completed the preparation and editing of a paper of one thousand pages on the Hemiptera of Connecticut, for the Natural History Survey. Fifteen specialists have coöperated in its preparation. The check list of Connecticut insects, by the Entomologist, is now being printed as Bulletin 31 of the Survey.

This department has prepared Bulletin 216 on Insects Attacking Squash, Cucumber and Allied Plants in Connecticut, and the Annual Report of the State and Station Entomologist, Bulletin 218.

MOSQUITO ELIMINATION.

S. T. Sealy in Charge.

This work, required by statute, is closely related to that of the entomologist, under whose general supervision it has been carried on for a term of years. This year Mr. Sealy has been in direct charge of it.

A constant patrol has been maintained on all the drained salt marsh in Fairfield, Orange, New Haven, East Haven, Branford, Guilford and Madison, the total area of drained marsh being 5,000 acres. Supplementary ditches have been made where necessary and the outlets to the sea reopened when blocked with sand thrown up by storms.

At no time have any considerable broods of mosquitoes developed on the drained marshes. The trouble has mainly come from neighboring marshes which are not ditched, and from the "rain barrel" mosquitoes, which breed in stagnant fresh water about houses and inland pools.

The only new ditching this year has been a tract of 60 acres at Groton Long Point.

THE FORESTRY DEPARTMENT.

Mr. Filley in Charge.

Owing to labor shortage, forest plantings were greatly reduced this year, only 11,700 trees being set on the State and Station forest areas. Eleven examinations of forest land have been made for the owners, to advise as to management and planting.

BLISTER RUST WORK.

The blister rust control work has been carried on by this department under the direct supervision of Mr. Hicock, the botanical department coöperating in studies on the nature and method of spread of the disease. An eradication camp was established in Colebrook, and during July and August more than 2,000 acres were freed from currant and gooseberry plants in an area east of that worked in previous years in Norfolk. Over 80 per cent. of this is forest land and contains much pine reproduction as well as some old timber. Some pine blister rust infection was found. Mr. Hicock scouted the northwestern corner of the State, finding no new pine infection centers, but the *ribes* infection is general throughout Litchfield county. Careful examination indicates that in the eradication area no pine infections have occurred since 1916 when the work was begun.

WORK BY STATE PARK COMMISSIONER.

The assistant forester, Mr. Moss, was employed by the State Park Commission from July to December, 1919, in gathering data for a topographic and type map of Macedonia State Park, a tract of 2,000 acres, chiefly woodland, in the town Kent.

STATE FORESTS.

As State Forester, Mr. Filley has added 408 acres to the Eastford State Forest, making the total area of State Forests 4,267 acres.

About $2,500 was received for ties, poles and cord wood, and 10,000 pines were set on the cut-over land.

STATE FOREST FIRE WARDEN.

As State Forest Fire Warden, Mr. Filley reports that, because of weather conditions, much less damage by forest fires has been done this year than is usual.

In 1919 there were 720 forest fires, but only 39 of these occurred after October 1st, and during the first six months of the present year, only 349. The property damage in 1919 was $78,000, and for the first six months of 1920, only $35,000. This decrease is almost entirely due to weather conditions, as the fire warden service has been greatly handicapped by labor cost.

TREE PROTECTION EXAMINING BOARD.

The botanist, entomologist and forester of this Station are a board required by law to examine commercial tree workers as to their fitness for improving trees by pruning, filling, spraying, etc. The forester is secretary of this board. In the 12 months ending June 30, 1920, 59 applicants were examined and 55 certificates issued. Three certificates were refused. From July 1, 1920, to September 30, 1920, one new certificate was issued and thirty-four certificates were renewed. It has been necessary to examine the work of some applicants before issuing certificates and to investigate a few complaints. No certificates have been revoked because of improper method.

THE DEPARTMENT OF MARKET GARDENING.

Mr. Pelton in Charge.

A study of the Hahto Soy Bean, edible in its green state and a possible substitute for lima beans, was begun and material gathered for improvement by selection. Tests of seedmen's varieties and strains of onions, string beans, carrots and beets bearing on the standardization of crops, and comparisons of yield and quality of strains of other vegetables were begun and carried through one season. Studies on the soil of the Wallingford plain were also undertaken.

It was with great regret that this work, which promised to be very useful, had to be dropped soon after it was well under way.

Mr. Pelton resigned in May, 1920, to accept a position in another institution, and a successor was not appointed as it was evident that it could not be done with the funds at the disposal of the Station but only by creating a deficit.

RESEARCHES SUPPORTED BY THE ADAMS FUND.

Dr. Osborne and Dr. Jones in Charge.

It is required by Federal authorities, who control the payments from this fund, that it shall be entirely spent in research on subjects approved by the Office of Experiment Stations and preferably on projects continued through a term of years.

One of these projects in charge of Dr. Osborne is a study of the different protein bodies found in food products and of their relative value in nutrition.

The current work under this project consists of elaborate studies of the proteins of the green leaves, a subject which has hitherto not been investigated to any considerable extent, and which the agricultural importance of these food stuffs seems to render most timely.

By methods which Dr. Osborne has developed, it has become possible to isolate and purify the proteins of green, actively growing plants, either before or after drying, in spite of the special difficulties which such work presents.

It will therefore be possible to subject these proteins to the same rigid study which the proteins of the seeds and grains have already received in this laboratory.

The publications of this department are listed on a following page.

In the field of nutrition investigations a study is being made of the quantitative and qualitative aspects of vitamine problems which have been raised by the experience gained in the Station work during the past few years; likewise a study of the role of fats *per se* in the ration.

The second project on problems of inheritance is in charge of Dr. Jones.

A new tobacco, "Connecticut Round Tip," being a combination of Sumatra with broad leaf, which has been established by years of selection, has been tested by thirteen growers, in amounts ranging from one-half acre to eight acres. Its superiority to Connecticut Havana is in shape of leaf, somewhat larger growth, greater number of leaves, and better resistance to adverse soil conditions. Competent judges consider it a most promising variety which deserves further careful trial.

A hybrid type of corn derived from inbred strains by a process called "double crossing," has been grown in some twenty different parts of the State.

The corn variety testing work, in coöperation with the Storrs Station, is being continued until all the promising varieties so far located have been grown at least three years.

The investigations dealing with the process of heredity in corn and tobacco are being continued.

The publications of this department are listed on a following page.

Library and Collections.

The Station library now numbers something over 5,300 bound volumes insured for $20,000. The botanical collection numbers over 48,000 specimens, and the entomological collection over 20,800 specimens of which 5,300 are determined and arranged systematically.

Publications.

During the year the Station has issued the annual report for 1919, consisting of Bulletins 215 to 222, and Bulletins of Immediate Information, Nos. 10 and 11, aggregating in all 487 pages, with 60 full page plates.

A considerable part of the research work of the Station cannot be printed in its bulletins, partly because space is lacking, and partly because the subject matter is not of immediate practical value to farmers, to whom the larger part of our editions is sent.

Following is a list of papers written by members of the Staff and published elsewhere than in Station publications:

By T. B. Osborne and others in his Department:

Do Fruits Contain Water-Soluble Vitamine? Thomas B. Osborne and Lafayette B. Mendel. Proc. Soc. Exper. Biol. and Med. (1919) XVII, 46-47.

Extraction and Concentration of the Water-Soluble Vitamine from Brewer's Yeast. Thomas B. Osborne and Alfred J. Wakeman. Jour. Biol. Chem. (1919) XL, 383-394.

Nutritive Value of the Proteins of the Barley, Oat, Rye and Wheat Kernels. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLI, 275-306.

Nutritive Factors in Plant Tissues. III. Further Observation on the Distribution of Water-Soluble Vitamine. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLI, 451-468.

Fat-Soluble Vitamine of Green Foods. Thomas B. Osborne and Lafayette B. Mendel. Proc. Am. Soc. Biol. Chem., Jour. Biol. Chem. (1920) XLI, p. vii.

Nutritive Factors in Plant Tissues. IV. Fat-Soluble Vitamine. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLI, 549-565.

Milk as a Source of Water-Soluble Vitamine. II. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLI, 515-523.

The Proteins of Green Leaves. I. Spinach Leaves. Thomas B. Osborne and Alfred J. Wakeman. Jour. Biol. Chem. (1920) XLII. 1-26.

The Water-Soluble Vitamine. Thomas B. Osborne. N. Y. State Jour. Med. (1920) XX, 217-222.

The Occurrence of Water-Soluble Vitamine in Some Common Fruits. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLII, 465-489.

Does Gliadin Contain Amide Nitrogen? Thomas B. Osborne and Owen L. Nolan. Jour. Biol. Chem. (1920) XLIII, 311-316.

Nutrition Experiments with Rats. A Description of Methods and Technic. Edna L. Ferry. Jour. Lab. and Clin. Med. (1920) V, 735-745.

BY D. F. JONES.

Teas' Hybrid Catalpa. D. F. Jones and W. O. Filley. Jour. Heredity (1920) **11**: 1-9.

A Paraffine Ruler for Drawing Curves. D. F. Jones. Science, N. S. (1920) **51**: 245.

Selection in Self-Fertilized Lines as the Basis for Corn Improvement. D. F. Jones. Jour. Amer. Soc. Agron. (1920) **12**: 77-100.

Heritable Characters in Maize, IV. A Lethal Seed Factor.—Defective Seeds. D. F. Jones. Jour. Heredity (1920) 11, 161-167.

Selective Fertilization in Pollen Mixtures. D. F. Jones. Biological Bulletin (1920) **38**: 251-289. Abstract in Proc. Nat. Acad. Science (1920) **6**: 66-70.

BY G. P. CLINTON AND FLORENCE MCCORMICK.

Artificial Infection of Pine with *Cronartium ribicola*. Amer. Plant Pest Committee, Bull. 4.

BY G. P. CLINTON.

Biographical Notice of Prof. W. G. Farlow. Phytopathology (1920) X, 1-7.

BY W. E. BRITTON.

Some Phases of Beekeeping in Connecticut. Jour. of Econ. Entomology (1920) **13**: p. 91.

A Connecticut Corn Field Injured by *Crombus præfectellus*, Zinck. Jour. of Econ. Entomology (1920) **13**: p. 222.

More about the Cyclamen Mite. Florists' Exchange (1920) XLIX, p. 285.

The following statistical summary includes some features not referred to earlier in this report:

Number of letters written	9,603
Fertilizers analyzed	600
Feeds analyzed	764
Foods and Drugs analyzed	2,400
Babcock apparatus tested	2,462
Nurseries, orchards and gardens inspected	160
Imported nursery stock inspected (cases)	87
Apiaries inspected	480
Specimens identified for applicants	406
Papers published in scientific journals	19
Addresses delivered	61

THE PRESENT CONDITION AND NEEDS OF THE STATION.

The salaries paid by this Station have been lower than those paid for corresponding ability and experience in other agricultural institutions, and, in consequence, within the last biennial period valued members of the Station Staff have resigned to accept more adequate salaries elsewhere.

The increased cost of all materials and of labor has also added to the difficulties which have confronted this and all other stations.

Owing to an unprecedented increase in the work required for the dairy and food commissioner, the appropriation of $2,500 per year for the work was so grossly inadequate that the State Board of Control granted $2,500 to meet the emergency.

With this aid and by the utmost economy, involving the suspension of the department of vegetable growing, the Station has avoided a deficit, the treasurer's account showing a balance of $13.45 at the end of the fiscal year.

But to keep within the present appropriation has involved loss of efficiency, which if continued, must, we feel, result in serious injury to agricultural interests. The work of the agricultural station is fundamental. It forms the basis of the teaching of the Agricultural College and Extension Department. Like all fundamental work, it is not in the public eye, it cannot be exploited in print, and its help to agriculture is not generally and justly appreciated and valued.

But it is certain that if the investigation and experiment carried on at the Station lose in character and amount, there will be corresponding loss in the character of the teaching and practice of agriculture.

We shall therefore ask the next General Assembly for a considerable increase of the appropriation hitherto made to this Station.

All of which is respectfully submitted.

GEORGE A. HOPSON,
Secretary.

New Haven, Connecticut, October 31, 1920.

REPORT OF THE TREASURER.

July 1, 1919–June 30, 1920.

E. H. Jenkins, in account with The Connecticut Agricultural Experiment Station for the fiscal year ending June 30, 1920.

Receipts.

Balance on hand, July 1, 1919 (Analysis Fees)		$9.76
State Appropriation, General	$22,500.00	
State Appropriation, Food	2,500.00	
State Appropriation, Food Deficiency	2,500.00	
State Appropriation, Insect Pest	7,500.00	
United States Appropriation, Hatch	7,500.00	
United States Appropriation, Adams	7,500.00	
Fertilizer Analysis	10,019.33	
Connecticut Agricultural College (for A. E. Moss)	1,250.00	
Connecticut State Department of Health (rent)	200.00	
State Park Commission (for A. E. Moss)	500.00	
New Laboratory Appropriation (for moving greenhouses)	511.77	
Mosquito Elimination Appropriation (for automobile)	650.00	
Sale of Gasoline and Oil	336.58	
Interest on Bank Deposits	99.49	
Miscellaneous	69.32	
Lockwood Trust Income (including sale of tree seedlings and wood and Mt. Carmel Farm produce, $2,483.54)	11,483.54	
		75,120.03
		$75,129.79

Disbursements.

E. H. Jenkins, director,	salary	$2,800.00
E. H. Jenkins, treasurer,	"	400.00
V. E. Cole,	"	1,300.00
L. M. Brautlecht,	"	900.00
J. P. Street,	"	216.67
T. B. Osborne,	"	3,000.00
E. M. Bailey,	"	2,766.67
C. B. Morison,	"	574.74
C. E. Shepard	"	1,700.00
W. E. Britton,	"	2,783.34
G. P. Clinton,	"	2,783.34
E. M. Stoddard,	"	1,581.25
W. O. Filley,	"	2,775.00
A. E. Moss,	"	2,250.00
E. L. Ferry,	"	399.99
D. F. Jones,	"	2,683.33
Michael D'Esopo,	"	462.49
Florence McCormick,	"	816.66
W. C. Pelton,	"	1,741.67
H. D. Edmond,	"	1,200.00
R. E. Andrew,	"	1,540.00
V. L. Churchill,	"	1,200.00
Wm. Veitch,	"	894.58
Etta L. Avery,	"	366.67

C. D. Hubbell,	salary	$ 880.00	
G. E. Graham,	"	1,133.33	
Alta H. Moss,	"	555.00	
H. W. Hicock,	"	250.00	
L. J. Treadwell,	"	245.00	
Owen Nolan,	"	360.00	
P. A. Merchant,	"	133.33	
Mrs. L. D. Kelsey,	"	572.00	
Henry Kiley		1,115.00	
O. J. Welch		1,115.00	
Herbert Edwards		286.67	
Leonal Hand		813.33	
T. F. Barrows		605.00	
Frank Sheldon		1,040.00	
Richard Merwin		394.00	
Ervin Applegate		554.00	
Labor		3,317.96	
Publications		398.37	
Postage		226.90	
Stationery		585.13	
Telephone and Telegraph		223.07	
Freight and Express		99.97	
Gas, Electricity and Kerosene		1,009.23	
Coal		1,984.32	
Water		132.45	
Chemicals		545.50	
Laboratory Supplies		377.36	
Seeds, Plants, etc.		247.90	
Agricultural and Horticultural Supplies		155.28	
Food Samples		25.85	
Ice		106.30	
Photographic Supplies		125.15	
Automobile Oil		25.77	
Miscellaneous Supplies		632.47	
Fertilizers		1,009.46	
Feeding Stuffs		524.49	
Library (Books and Periodicals)		477.49	
Library (Binding)		88.00	
Tools, Machinery and Appliances		2,145.43	
Tools, Machinery and Appliances (Repairs)		640.11	
Furniture and Fixtures		122.90	
Furniture and Fixtures (Repairs)		40.30	
Scientific Apparatus		4.75	
Scientific Apparatus (Repairs)		37.29	
Live Stock		16.50	
Traveling by the Board		146.33	
Traveling by the Staff		1,053.66	
Gasoline for Automobiles		673.12	
Travel in connection with Adams Fund Investigations		103.26	
Insurance		1,437.34	
Insect Pest Appropriation to State Entomologist		7,500.00	
Contingent		308.47	
Buildings and Land (Betterments)		68.28	
Buildings and Land (Repairs)		1,218.25	
Buildings and Land (Grounds)		93.87	
Total Disbursements			$75,116.34
Balance on hand, June 30, 1920 (Analysis Fees)			13.45
			$75,129.79

New Haven, Conn., Sept. 28, 1920.

This is to Certify that we have audited the accounts of E. H. Jenkins, Treasurer of the Conn. Agricultural Experiment Station for the fiscal year ending June 30, 1920, and have found them correct.

William P. Bailey,
Lewis W. Phelps,
Auditors of Public Accounts.

Connecticut
Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 223 **OCTOBER, 1920**

Fertilizer Report for 1920

By E. H. JENKINS, *Director, and*
E. MONROE BAILEY, *Chemist in Charge of the Analytical Laboratory.*

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF

October 31, 1920.

BOARD OF CONTROL.

His Excellency, Marcus H. Holcomb, *ex-officio*, *President*.

James H. Webb, *Vice President*	Hamden
George A. Hopson, *Secretary*	New Haven
E. H. Jenkins, *Director and Treasurer*	New Haven
Joseph W. Alsop	Avon
Charles R. Treat	Orange
Elijah Rogers	Southington
William H. Hall	South Willington

STAFF.

Administration.	E. H. Jenkins, Ph.D., *Director and Treasurer.* Miss V. E. Cole, *Librarian and Stenographer.* Miss L. M. Brautlecht, *Bookkeeper and Stenographer.* William Veitch, *In charge of Buildings and Grounds.*
Chemistry.	
Analytical Laboratory.	E. Monroe Bailey, Ph.D., *Chemist in Charge.* R. E. Andrew, M.A., C. E. Shepard, H. D. Edmond, B.S., Owen L. Nolan, *Assistant Chemists.* Frank Sheldon, *Laboratory Assistant.* V. L. Churchill, *Sampling Agent.* Miss A. H. Moss, *Clerk.*
Protein Research.	T. B. Osborne, Ph.D., D.Sc., *Chemist in Charge.*
Botany.	G. P. Clinton, Sc.D., *Botanist.* E. M. Stoddard, B.S., *Assistant Botanist.* Miss Florence A. McCormick, Ph.D., *Scientific Assistant.* G. E. Graham, *General Assistant.* Mrs. L. D. Kelsey, *Stenographer.*
Entomology.	W. E. Britton, Ph.D., *Entomologist; State Entomologist.* B. H. Walden, B.Agr., John T. Ashworth, M. P. Zappe, B.S., Philip Garman, Ph.D., *Assistant Entomologists.* Samuel T. Sealy, *Deputy in Charge of Mosquito Control.* Miss Gladys M. Finley, *Stenographer.*
Forestry.	Walter O. Filley, *Forester, also State Forester and State Forest Fire Wa* A. E. Moss, M.F., *Assistant State and Station Forester.* H. W. Hicock, M.F., *Assistant Forester.* Miss Pauline A. Merchant, *Stenographer.*
Plant Breeding.	Donald F. Jones, S.D., *Plant Breeder.* C. D. Hubbell, *Assistant.*
Vegetable Growing.	———————

Press of
The Wilson H. Lee Company

Report on Commercial Fertilizers, 1920.

BY E. H. JENKINS, *Director, and* E. M. BAILEY,
Chemist in Charge of the Analytical Laboratory.

In 1920, sixty-seven individuals and firms registered for sale in this State 502 brands of commercial fertilizers, classified as follows:

Nitrogenous superphosphates	364
Cotton seed meal and castor pomace	103
Other chemicals and unmixed materials	41
	508

The law requires that a list of the registered brands shall be published annually.

The following is such a list of all brands of fertilizers registered for sale in this State between January 1 and December 31, 1920.

BRANDS REGISTERED FOR THE FISCAL YEAR ENDING DEC. 31, 1920.

Alpha Portland Cement Co., Easton, Pa.
Alpha Potash-Lime Fertilizer

American Ag'l Chemical Co., 2 Rector St., New York City
14% Acid Phosphate
16% Acid Phosphate
Ammoniated Fertilizer A
Ammoniated Fertilizer AA
Ammoniated Fertilizer AAA
Ammoniated Fertilizer AAAA
Ammoniated Fertilizer VX
Basic Lime Phosphate
Bone-Phosphate and Potash
Castor Pomace
Cereal and Root Fertilizer
Double A Tobacco Fertilizer
Dry Ground Fish
Fine Ground Bone
Fish and Potash
Five Eight Fertilizer
Grass and Lawn Top Dressing
Grass and Oats Fertilizer
High Grade Acid Phosphate
High Grade Ground Bone
Monarch Potato Manure
Nitrate of Soda
Pulverized Sheep Manure
Special Vegetable Fertilizer
Sure Growth Phosphate Revised

Tobacco Special
Universal Phosphate
Bradley's Alkaline Bone with Potash
Bradley's B. D. Guano
Bradley's Corn Phosphate
Bradley's Half Century Fertilizer Revised
Bradley's New Method Fertilizer
Bradley's Patent Superphosphate Revised
Bradley's Potato Fertilizer
Bradley's Potato Manure
Bradley's Root Crop Manure
Bradley's Special Bay State
Bradleys Special Corn Phosphate without Potash
Bradley's Special Potato Fertilizer without Potash
Bradley's Special Potato Manure without Potash
Bradley's Unicorn
Bradley's Valley Tobacco Fertilizer
Bradley's X L Superphosphate of Lime
E. I. Black Hawk Potato and Truck Fertilizer
E. I. Corn King Revised
E. I. Economizer Phosphate
E. I. Mayflower
E. I. Tobacco Fertilizer
E. I. Unexcelled Fertilizer Revised
G. E. General
G. E. Northern Corn Special 1920
G. E. Potato Manure 1920
Packers' Union Animal Corn Fertilizer
Packers' Union Potato Manure 1920
Packers' Union Universal Fertilizer 1920
Quin. Ammoniated Dissolved Phosphate
Quin. Climax Phosphate
Quin. Corn Manure
Quin. Phosphate
Quin. Potato Phosphate
Quin. Potato Manure
Quin. Spl. Corn Manure without Potash
Quin. Spl. Potato Phosphate without Potash
Quin. Wrapper Leaf Brand Tobacco Manure Revised
Wheeler's Corn Fertilizer
Wheeler's Cuban Tobacco Grower
Wheeler's Potato Manure 1920
Williams & Clark's Americus Ammoniated Bone Superphosphate
Williams & Clark's Americus H. G. Spl. Revised
Williams & Clark's Americus Corn Phosphate
Williams & Clark's Americus Potato Manure
Williams & Clark's Matchless Fertilizer
Williams & Clark's Meadow Queen Fertilizer
Williams & Clark's Potato Phosphate
Williams & Clark's Prolific Fertilizer
Williams & Clark's Seed Leaf Tobacco Manure Revised
Williams & Clark's Spl. Americus Corn Phosphate without Potash
Williams & Clark's Spl. Americus Potato Manure without Potash

American Nitro-Phospho Corporation, 80 Lafayette St., New York City
Phosphogerm (Inoculated Organic)

Apothecaries Hall Co., Waterbury, Conn.
Acid Phosphate
Castor Pomace
Consolidated Rendering Co.'s Steamed Bone

Fish
Liberty Corn, Fruit and All Crops
Liberty Market Gardeners' Special
Liberty Market Gardeners' Special (Potash)
Liberty Potato and Vegetable Special
Liberty Sheep Manure
Liberty Tobacco Special
Liberty Tobacco Special (Potash)
Liberty Top Dresser for Grass and Grain
Nitrate of Soda
Raw Ground Phosphate Rock
Tankage

Armour Fertilizer Works, 305 Broadway, New York City.
Armour's Acid Phosphate Fertilizer
Armour's Bone Meal
Armour's Cereal Special No. 1 Fertilizer
Armour's Cereal Special No. 2 Fertilizer
Armour's Cereal Special No. 3 Fertilizer
Armour's Complete Potato Fertilizer
Armour's Crop Grower
Armour's 4-10-0 Fertilizer
Armour's 4-8-5 Fertilizer
Armour's Gardeners' Choice Fertilizer
Armour's General Crop Fertilizer
Armour's Grain Grower Fertilizer
Armour's Nitrate of Soda
Armour's Potato, Onion and Vegetable Fertilizer
Armour's Sheep Manure
Armour's Spl. Tobacco Grower No. 2 Fertilizer
Armour's Super-Grade Potato Mixture Fertilizer
Armour's Tobacco Special Fertilizer
Armour's Tobacco Special Fertilizer (5-4-3)
Armour's Wheat and Clover Fertilizer
Bidwell's Formula

Ashcraft-Wilkinson Company, Candler Building, Atlanta, Ga.
Paramount Brand Good Cotton Seed Meal

Atlantic Packing Co., New Haven, Conn.
Atlantic Fine Bone Meal
Atlantic Grain Fertilizer
Atlantic Potato Phosphate
Atlantic Special Vegetable
Atlantic 3-8-3
Atlantic Tobacco Grower
Atlantic Tobacco Special
Atlantic 2-8
Atlantic 2-8-3
Atlantic 4-8
Dry Ground Fish
Ground Tankage
Nitrate of Soda

Baker Castor Oil Co., 120 Broadway, New York City.
Castor Pomace

Barrett Company, 17 Battery Place, New York City.
Arcadian Sulphate of Ammonia

Berkshire Fertilizer Co., Bridgeport, Conn.
Berkshire Ammoniated Bone Phosphate
Berkshire Complete Fertilizer

Berkshire Complete Tobacco
Berkshire Dry Ground Fish
Berkshire Economical Grass Fertilizer
Berkshire Fine Ground Bone
Berkshire Grass Special
Berkshire Long Island Special
Berkshire Market Garden Fertilizer
Berkshire Potato and Vegetable Phosphate
Berkshire Tobacco Grower
Berkshire Tobacco Starter
Acid Phosphate
Castor Pomace
Nitrate of Soda
Sheep Manure

Boardman, F. E., Middletown, Conn.
Boardman's Fertilizer for General Crops

Bowker Fertilizer Company, 60 Trinity Place, New York City.
Bowker's All Round Fertilizer
Bowker's Conn. Valley Tobacco Fertilizer
Bowker's Corn, Grain and Grass Phosphate
Bowker's Fisherman's Brand Fish and Potash
Bowker's Four Ten Hill and Drill
Bowker's Fresh Ground Bone
Bowker's Hill and Drill Phosphate
Bowker's Lawn and Garden Dressing Revised
Bowker's Nitrate of Soda
Bowker's Potato and Vegetable Phosphate
Bowker's 16% Acid Phosphate
Bowker's Soluble Phosphate
Bowker's Square Brand Farm and Garden Phosphate
Bowker's Superphosphate with Ammonia 1%
Bowker's Superphosphate with Ammonia 2%
Bowker's Superphosphate with Ammonia 3%.
Bowker's Superphosphate with Ammonia 4%
Bowker's Superphosphate with Ammonia 5%
Bowker's Sure Crop Phosphate Revised
Bowker's Three Ten All Round
Bowker's Tobacco Grower
Bowker's Two Ten Farm and Garden
Stockbridge Complete
Stockbridge Market Garden Manure
Stockbridge Tobacco Manure
Stockbridge Top Dressing and Forcing Manure

Breck, Joseph, & Sons, Corp'n, 51 North Market St., Boston, Mass.
Breck's Rams Head Brand Sheep Manure

Brodé, F. W., & Co., 119 Madison Ave., Memphis, Tenn.
Dove Brand Cotton Seed Meal
Jay Brand Cotton Seed Meal
Owl Brand High Grade Cotton Seed Meal

Buckeye Cotton Oil Company, Cincinnati, Ohio.
Buckeye Good Cotton Seed Meal
"Buco" Cottonseed Feed

Chicago Feed & Fertilizer Company, 809 Exchange Ave., Union Stock Yards, Chicago, Ill.
Magic Brand Pulverized Sheep Manure

Chittenden, E. D., Company, Bridgeport, Conn.
Chittenden's Complete Tobacco and Onion Grower
Chittenden's Complete Tobacco and Onion Grower without Potash
Chittenden's Tobacco Special with 5% Potash
Chittenden's Tobacco Special without Potash
Chittenden's Vegetable and Onion Grower without Potash

Clark, Everett B., Seed Company, Milford, Conn.
Special Mixture for General Use
Special Mixture with Potash

Coe-Mortimer Co., 51 Chambers St., New York City.
E. Frank Coe's Basic Fruit and Legume Phosphate (Basic Lime Phosphate) (Key-Plow Brand)
E. Frank Coe's Celebrated Special Potato Fertilizer Revised
E. Frank Coe's Columbian Corn and Potato Fertilizer
E. Frank Coe's Connecticut Wrapper Grower
E. Frank Coe's Corn King
E. Frank Coe's Dissolved Phosphate and Potash
E. Frank Coe's Gardeners' and Truckers' Special 1916
E. Frank Coe's Gold Brand Excelsior Guano Revised
E. Frank Coe's H. G. Ammoniated Superphosphate 1916
E. Frank Coe's New Englander Special
E. Frank Coe's Nitrate of Soda
E. Frank Coe's Prolific Crop Producer 1916
E. Frank Coe's 16% Superphosphate
E. Frank Coe's Special Grass Top Dressing
E. Frank Coe's Tobacco Leaf Fertilizer
E. Frank Coe's Tobacco Special
Fine Ground Bone

Columbia Guano Co., Munsey Building, Baltimore, Md.
Columbia Freedom Guano
Columbia Soluble Guano

Conn. Fat Rendering & Fertilizing Corp'n., P. O. Box 228, New Haven, Conn.
Tankage

Davis, S. P., Little Rock, Ark.
Good Luck Brand of Cottonseed Meal and Cracked Screened Cake

Dexter Portland Cement Co., Nazareth, Pa.
Dexter Potash Lime Fertilizer

Essex Fertilizer Company, 39 North Market St., Boston, Mass.
Essex Fish Fertilizer 3-8-3
Essex Market Garden 3-8-4
Essex Tobacco 5-5-4
Essex Tobacco 5-6
Essex Tobacco 5-7-2
Essex 1-10-1
Essex 2-8-2
Essex 3½-10
Essex 4-8-4

Fertile Chemical Company, Cleveland, Ohio.
Lime-Fertile
Nitro-Fertile

Frisbie, L. T., Co., New Haven, Conn.
Castor Pomace
Frisbie's Acid Phosphate 16%
Frisbie's Corn and Grain Fertilizer

Frisbie's Fine Bone Meal
Frisbie's 5-8
Frisbie's Special
Frisbie's Special Vegetable and Potato Grower
Frisbie's 3-8
Frisbie's 3-8-3
Frisbie's Tobacco 5-5-5
Frisbie's Tobacco 5-6
Frisbie's Tobacco Grower
Frisbie's Tobacco Special
Frisbie's 2-8
Frisbie's 4-10
Ground Tankage
Nitrate of Soda

Hall, W. D., Company, Atlanta, Ga.
Good Cotton Seed Meal

Hubbard Fertilizer Co., 802 Keyser Bldg., Baltimore, Md.
Hubbard's Excelsior Mixture
Hubbard's Farmers I X L
Hubbard's 5% Royal Seal
Hubbard's 4-10-0
Hubbard's New England Special
Hubbard's Nitrate of Soda
Hubbard's Noxall Guano
Hubbard's 16% Phosphate
Hubbard's Tobacco Fertilizer
Hubbard's Yellow Wrapper

Humphreys-Godwin Co., Memphis, Tenn.
Bull Brand Cottonseed Meal
Danish Brand Cottonseed Meal
Dixie Brand Cottonseed Meal
Forfat Brand Cottonseed Meal
Unit—1
Unit—2

Industrial Cotton Oil Properties, 65 Broadway, New York City.
"High Grade Cotton Seed Meal"

International Agricultural Corporation, Buffalo Fertilizer Works, Buffalo, N. Y.
Bone Meal
Buffalo Ammoniated Phosphate
Buffalo Economy
Buffalo Farmers Choice
Buffalo General Favorite
Buffalo High Grade Manure
Buffalo New England Special
Buffalo Onion, Vegetable and Potato
Buffalo Phosphate and Potash
Buffalo Three Ten
Buffalo Tobacco Grower
Buffalo Tobacco Producer
Buffalo Tobacco Special
Buffalo Top Dresser and Starter
I. A. C. Tobacco Crop

Joynt, John, Lucknow, Ont.
The Joynt Brand Canada Unbleached Hardwood Ashes

Koster, A. L., Suffield, Conn.
Dry Ground Fish
Hale Tobacco Mixture

Listers Agricultural Chemical Works, Newark, N. J.
Listers Ammoniated Dissolved Superphosphate Revised
Listers Bone Meal 1916
Listers Buyer's Choice Acid Phosphate
Listers Celebrated Ground Bone and Tankage Acidulated
Listers Celebrated Tobacco Fertilizer
Listers Complete Tobacco Manure
Listers Corn and Potato Fertilizer
Listers Eastern Pride Fertilizer
Listers H. G. Acid Phosphate
Listers King Bee Fertilizer
Listers Plant Food 1916
Listers Special Crop Producer
Listers Special Tobacco Fertilizer
Listers Standard Pure Superphosphate of Lime
Listers Success Fertilizer
Listers Superior Ammoniated Superphosphate 1916

Lovitt, L. B., & Co., Memphis, Tenn.
"Maloney's Pride No. 1" (7)
"Maloney's Pride No. 2" (6)
"Maloney's Pride No. 3" (8)

Lowell Fertilizer Co., 40 North Market St., Boston, Mass.
Acid Phosphate 16%
Lowell Animal Brand 3-8-4
Lowell Bone Fertilizer 2-8-2
Lowell Dissolved Bone Fertilizer 2-10
Lowell Empress Brand 1-10-1
Lowell 3½-10
Lowell 2-8-3
Lowell 3-8-3
Lowell 4-8-4
Lowell 5-8
Lowell 5-8-4
Lowell Ground Bone 2½-26
Lowell Lawn and Garden Dressing 4-7-2
Lowell Tobacco 5-5-4
Lowell Tobacco 5-6
Lowell Tobacco 5-7-2
Nitrate of Soda

Lyle & Lyle, Huntsville, Ala.
"Economy" C. S. Feed

Mapes Formula & Peruvian Guano Co., 143 Liberty St., New York City.
Mapes Corn Manure
Mapes C. S. Tobacco Manure
Mapes General Crop (1916 Brand)
Mapes General Tobacco Manure
Mapes General Truck Manure
Mapes Grain Brand
Mapes Potato Manure
Mapes Potato Manure (1916 Brand)
Mapes Tobacco Starter, Improved

National Fertilizer Co., 60 Trinity Place, New York City.
National Ammoniated Bone Phosphate
National Complete Grass Fertilizer

National Complete Tobacco Fertilizer
National Eureka Potato Fertilizer
National 5-4 Tobacco Manure
National Market Garden Fertilizer Revised
National Nitrogen Phosphate Mixture No. 1
National Nitrogen Phosphate Mixture No. 2
National Nitrogen Phosphate Mixture No. 3
National Nitrogen Phosphate Mixture No. 4
National Nitrogen Puosphate Mixture No. 6
National Pine Tree State Potato Fertilizer
National Potato Phosphate
National 16% Plain Superphosphate
National Soluble Bone and Potash
National Special Tobacco Revised
National Universal Phosphate
National XXX Fish and Potash

Natural Guano Co., Aurora, Ill.
"Sheep's Head" Pulverized Sheep Manure

New England Fertilizer Co., 40A North Market St., Boston, Mass.
N. E. Superphosphate 3-8-4
N. E. Tobacco 5-4
N. E. Tobacco 5-5-4
N. E. Tobacco 5-6
N. E. 1-10-1
N. E. 2-8-2
N. E. 2-8-3
N. E. 3-8-3
N. E. 3½-10
N. E. 5-8-7

Nitrate Agencies Co., 85 Water St., New York City.
N. A. C. Brand Acid Phosphate
N. A. C. Brand 8-6-5 Truckers Top Dresser
N. A. C. Brand 4-8-4 Potato Formula
N. A. C. Brand Ground Bone
N. A. C. Brand Muriate of Potash
N. A. C. Brand Nitrate of Soda
N. A. C. Brand 2-8-2 All Crop Formula

Nothern, W. C., Box 414, Memphis, Tenn.
Special No. 1 (Cotton Seed Meal)

Olds & Whipple, Hartford, Conn.
Acid Phosphate
Nitrate of Soda
O & W Complete Corn, Potato and Onion Fertilizer
O & W Complete Tobacco Fertilizer
O & W Dry Ground Fish
O & W Grass Fertilizer
O & W H. G. Tobacco Starter
O & W Special Corn, Onion and Potato Fertilizer
O & W Tobacco Special Fertilizer
Precipitated Bone Phosphate

Pacific Manure & Fertilizer Co., 429 Davis St., San Francisco, Calif.
Groz-It-Brand Pulverized Sheep Manure

Park & Pollard Co., Boston, Mass.
P. & P. Offcolored Cottonseed Meal
Upland Cottonseed Meal

Parmenter & Polsey Fertilizer Co., 41 North Market St., Boston, Mass.
P & P Plymouth Rock 3-8-4
P & P Tobacco 5-4
P & P Tobacco 5-5-4
P & P 1-10-1
P & P 2-8-2
P & P 2-8-3
P & P 2-10
P & P 3½-10
P & P 4-8-4 for Potatoes, Corn and Vegetables

Pawtucket Rendering Co., Pawtucket, R. I.
Ground Bone
2-8-2 Brand
3-8-4 Animal Brand
4-8-4 Brand
5-8-4 Brand

Piedmont-Mt. Airy Guano Co., Baltimore, Md.
Brown's Fertilizer for Corn and Grain
Brown's H. G. P. and General Crop Manure
Brown's Potato Fertilizer
Brown's Special Fertilizer
Brown's Special O & T and Market Garden
Brown's Tobacco Manure
Muriate of Potash
Nitrate of Soda
Piedmont 3-8-4 Fertilizer
Piedmont 4-8-6 Fertilizer
Piedmont 16% Acid Phosphate
Piedmont 3 50 Bone Meal
Piedmont 6 30 Tankage
Shay's Corn Fertilizer
Shay's Potato Fertilizer
Shay's Special Fertilizer

Pulverized Manure Co., 828 Exchange Ave., Union Stock Yards, Chicago, Ill.
Wizard Brand Manure

Quality Fertilizer Works, 52 Canal St., Stamford, Conn.
Bartlett Brand Special Tree Fertilizer

Robinson, George B., Jr., 18 Broadway, New York City.
"Robin" Brand Cotton Seed Meal

Rogers & Hubbard Company, Middletown, Conn.
Hubbard's "Bone Base" Fertilizer for Seeding Down
Hubbard's "Bone Base" Oats and Top Dressing
Hubbard's "Bone Base" Soluble Corn and General Crops Manure
Hubbard's "Bone Base" Soluble Potato Manure
Hubbard's Pure Raw Knuckle Bone Flour
Hubbard's Strictly Pure Fine Bone
R. & H.'s All Soils-All Crops Phosphate
R. & H.'s Climax Tobacco Brand
R. & H.'s Complete Phosphate
R. & H.'s Cottonseed Meal
R. & H.'s Potato Phosphate
R. & H.'s Soluble Tobacco Manure
R. & H.'s Tobacco Grower, Vegetable Formula

Royster, F. S., Guano Company, 1603 Munsey Bldg., Baltimore, Md.
Dry Ground Fish
Kainit

Muriate of Potash
Nitrate of Soda
Royster's Arrow Head Tobacco Formula
Royster's Banner Guano
Royster's Bully Guano
Royster's Dreadnought Guano
Royster's Fish and Potash
Royster's Fish, Flesh and Foul Guano
Royster's Landmark Brand
Royster's Perfecto Tobacco Formula
Royster's Prime Fish Brand
Royster's Purity Brand
Royster's Quality Trucker
Royster's 16% Acid Phosphate
Royster's Truckers' Delight
Royster's Valley Tobacco Formula
Stevens Formula

Sanderson Fertilizer & Chemical Co., New Haven, Conn.
Sanderson's Acid Phosphate
Sanderson's Atlantic Coast Bone, Fish and Potash
Sanderson's Complete Tobacco Grower
Sanderson's Corn Superphosphate
Sanderson's Fine Ground Bone
Sanderson's Formula A
Sanderson's Formula B
Sanderson's H. G. Ammoniated Phosphate
Sanderson's Kelsey's Bone, Fish and Potash
Sanderson's Nitrate of Soda
Sanderson's Phosphate without Potash
Sanderson's Potato Manure
Sanderson's Special without Potash
Sanderson's Tobacco Grower
Sanderson's Top Dressing for Grass and Grain
Sanderson's Top Dressing for Grass and Grain without Potash
South American Sheep and Goat Manure

Shoemaker, M. L., & Co., Inc., Venango St. and Delaware Ave., Philadelphia, Pa.
Swift-Sure Bone Meal
Swift-Sure Superphosphate for General Use
Swift-Sure Superphosphate for Potatoes No. 1
Swift-Sure Superphosphate for Tobacco
Swift-Sure Tankage

Soper, J. E., Co., 206 Chamber of Commerce, Boston, Mass.
Pilgrim Cottonseed Meal
Pioneer Cottonseed Meal
Puritan Cottonseed Meal
Soper's 5% Nitrogen C/S Meal
Soper's 6% Nitrogen C/S Meal
Soper's 7% Nitrogen C/S Meal

Southern Cotton Oil Company, Falls Building, 22 N. Front St., Memphis, Tenn.
Cotton Seed Meal

Springfield Rendering Co., 88 Liberty St., Springfield, Mass.
Springfield Animal Brand
Springfield Fine Ground Bone
Springfield Grain and Grass
Springfield Tobacco Special

Taylor Commission Co., Atlanta, Ga.
(Good Cotton Seed Meal) Taylor Brand

Union Seed & Fertilizer Co., 65 Broadway, New York City.
American Red Tag Cotton Seed Meal
Surety Brand Cotton Seed Meal
Yellow Tag Cotton Seed Meal

Virginia-Carolina Chemical Co., Equitable Building, 120 Broadway, New York City.
V-C Bone Meal
V-C Challenge Brand
V-C Champion Brand
V-C Cherokee Brand
V-C Fish and Potash Brand
V-C Indian Chief Brand
V-C Monarch Brand
V-C Owl Brand
V-C Pawnee Brand
V-C Plant Food for Vegetables, Lawns and Flowers
Virginia-Carolina Plow Brand

Wilcox Fertilizer Company, Mystic, Conn.
Acid Phosphate
Eldredge Fish and Potash
Nitrate of Soda
Wilcox Corn Special
Wilcox Dry Ground Fish
Wilcox Fish and Potash
Wilcox Grain Fertilizer
Wilcox Grass Fertilizer
Wilcox High Grade Fish and Potash
Wilcox Potato and Vegetable Phosphate
Wilcox Potato Fertilizer
Wilcox Tobacco Special

Witherbee, Sherman & Company, 393 Main St., Worcester, Mass.
Barium-Phosphate Grade A
Barium-Phosphate Grade B
Barium-Phosphate Grade C
Ground Phosphate Rock
Nitrate of Soda

Woodruff, S. D., & Sons, Orange, Conn.
Sheep Manure
Woodruff's Home Mixture

Worcester Rendering Co., Auburn, Mass.
Prosperity Brand Royal Worcester Corn and Grain Fertilizer
Prosperity Brand Royal Worcester Ground Steamed Bone
Prosperity Brand Royal Worcester Potato and Vegetable Fertilizer
Prosperity Brand Royal Worcester Special Grain Fertilizer

World's Fertilizer Process Co., Sharpsburg, Pa.
Shur-Gro

During the year Mr. Churchill, the Station's Agent, has visited 105 towns and villages in the State and gathered 547 samples, in the manner provided by law. Twenty of these registered brands have not been sold in the State, and seventy-eight, although reported to have been sold in Connecticut, could not be found by the sampling agent and therefore have not been examined.

In the following pages are given the analyses of all the brands which were sampled, as well as those sent for analysis by individuals. Of the latter the Station is not responsible for the accuracy of the sampling, although pains have been taken to secure from the senders certification that the Station's method of sampling was followed.

CLASSIFICATION OF FERTILIZERS ANALYZED.

	Number of samples.
1. *Containing nitrogen as the chief active ingredient:*	
Nitrate of soda	14
Sulphate of ammonia	1
Cotton seed meal	115
Castor pomace	3
2. *Containing phosphoric acid as the chief active ingredient:*	
Barium-phosphate	3
Raw rock phosphate	2
Precipitated bone phosphate	1
Basic lime phosphate	2
Dissolved rock phosphate or acid phosphate	20
3. *Containing potash as the chief active ingredient:*	
Cotton hull ashes	1
Potash salts and potash-lime	4
4. *Raw materials containing nitrogen and phosphoric acid:*	
Fish manures	16
Slaughter house tankage	15
Bone manures	19
Mixed bone and tankage	1
Garbage tankage	1
5. *Mixed fertilizers:*	
Nitrogenous superphosphates without potash	92
Nitrogenous superphosphates with potash	246
Home mixtures	16
6. *Miscellaneous fertilizers and waste products:*	
Tobacco stems, stalks and dust	4
Nitro-Fertile and Lime-Fertile	2
Sheep manure	9
Wood ashes	19
Lime and lime-kiln ashes	4
Other miscellaneous materials	15
Total	625

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA.

Fourteen samples were analyzed as follows:

14484. Sold by the Berkshire Fertilizer Co., Bridgeport. Sampled at the factory.

14487. Sold by Apothecaries Hall Co., Waterbury. Stock of R. H. Morgan, West Cheshire.

14488. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of J. R. Reinhard & Sons, West Cheshire.

15149. Sold by Coe-Mortimer Co., New York. Stock of Conyer's Farm, Greenwich.

14479. Sold by Olds & Whipple, Hartford. Sampled at the factory.

14935. Sold by Piedmont-Mt. Airy Guano Co, Baltimore, Md. Stock of Farmers' Exchange, Woodstock.

15045. Sold by the Hubbard Fertilizer Co., Baltimore, Md. Stock of H. H. McKnight, Ellington.

14419. Sold by American Agricultural Chemical Co., New York. Stock of E. N. Austin, Suffield.

15205. Sold by the Atlantic Packing Co., New Haven. Sampled at the factory.

15206. Sold by L. T. Frisbie Co., New Haven. Stock of P. Schwartz Co., New London.

14477. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled at the factory.

14572. Sold by Wilcox Fertilizer Co., Mystic. Stock of G. R. Stannard, Branford.

15075. Sold by the Lowell Fertilizer Co., Boston. Stock of Litchfield County Coop. Association, Torrington.

14828. Sold by the Bowker Fertilizer Co., New York. Stock of F. B. Newton Est., Plainville.

TABLE I. ANALYSES OF NITRATE OF SODA.

Station No.	Per cent. of Nitrogen Guaranteed.	Found.	Cost per ton.	Nitrogen costs cents per pound.
14484	14.80	15.44	$70.00	22.6
14487	15.00	15.50	70.00	22.6
14488	15.00	15.54	74.75	24.0
15149	15.00	15.40	75.00	24.3
14479	15.00	15.34	75.00	24.4
14935	15.22	15.30	75.76	24.7
15045	15.22	15.24	76.15	24.9
14419	15.00	15.68	80.00	25.5
15205	15.00	15.16	80.00	26.4
15206	15.00	15.32	85.00	27.7
14477	15.00	15.42	86.75	28.1
14572	15.00	14.94	86.00	28.8
15075	15.00	15.28	90.00	29.4
14828	15.00	15.76	.....	....

The retail cash cost of nitrogen in nitrate of soda has ranged from 22.6 to 29.4 cents per pound, and has averaged 25.6 cents per pound.

SULPHATE OF AMMONIA.

One sample was examined.

14483. Sold by the Barrett Co., of New York City. Stock of Berkshire Fertilizer Co. Cost $100 per ton. It contained 20.92 per cent. nitrogen.

Nitrogen in this sample costs 23.9 cents per pound. Sulphate of ammonia and nitrate of soda have been altogether the cheapest forms of available nitrogen in our market.

COTTON SEED MEAL.

One hundred and fifteen samples have been examined, and their analyses appear in the following table.

The per cent of nitrogen has ranged from 5.10 to 8.11 per cent, the average being 6.50—very decidedly higher than in any season since 1916.

There has been considerable fluctuation in price during the winter and spring, the average being $79.55 per ton. Making no valuation of the phosphoric acid and potash in the meal, the average cost of nitrogen in meal has been 61.2 cents per pound.

If the phosphoric acid contained in the meal were credited at 7 cents per pound and potash at 12 cents per pound, the cost of nitrogen would be about 54½ cents per pound. Twenty-eight of the samples did not meet their guaranties, but eight of these were sold on a unit basis so that the buyer only paid for the actual amount of nitrogen received, which is altogether the most satisfactory basis of payment. The prices ranged from $70 to $90 per ton, following in some measure the fluctuations in the wholesale market.

TABLE II. ANALYSES OF COTTON SEED MEAL.

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen.		Cost per ton.
			Found.	Guaranteed.	
	American Cotton Oil Co., New York City.				
4807	American Red Tag, C. S. Meal	J. E. Phelps, Suffield	6.31	6.18	$68.12
	Ashcraft-Wilkinson Co., Atlanta, Ga.				
4512	Paramount Brand C. S. Meal	Station Agent from Rockville Milling Co	6.14	5.76	83.00
	F. W. Brodé & Co., Memphis, Tenn.				
14471	Owl Brand	A. D. Bridge's Sons, Inc., Hazardville	6.32	6.50	....
14491	Owl Brand, E. 74666	W. J. Reeves, Windsorville	6.18	6.50	75.10
14496	Owl Brand, C. & N. W., 180500	Spencer Bros., Suffield	6.90	6.85	79.19
14501	Owl Brand	E. H. Rollins, Granby	6.56	6.50	74.50
14715	Owl Brand	Station Agent from A. D. Bridge's Sons	6.27	6.50	87.00
14806	Owl Brand, N.Y. C., 230350	G. T. Soule, New Milford	6.64	6.50	80.00
14827	Owl Brand	Station Agent from G. E. Ackley Co., New Milford	6.63	6.50	80.00
14885	Owl Brand	S. F. Holcomb & Son, West Granby	6.89	6.50	77.00
14510	Jay Brand, S. P., 84389	Station Agent from A. D. Bridge's Sons, Hazardville	5.84	5.76	79.00
14443		E. H. Rollins, Granby	6.58	6.50	75.00
14444		E. H. Rollins, Granby	6.60	6.50	74.00
14490	G. E. T., 18543	William J. Reeves, Windsorville	6.68	6.50	81.20
14549	Soo L., 31488	G. T. Soule, New Milford	6.29	6.50	75.00
14551	Off Color, C. S. M., S. L. 104426	Ahern Bros., East Windsor Hill	6.65	6.50	......
14852	Off Grade, C. S. M., N. Y. C. 230350	A. W. Camp, Danbury	6.60	6.50	80.00
	Cotton Seed Products Co., Louisville, Ky.				
14988	Prime C. S. Meal	Station Agent from Wybern Farms, Melrose	6.21	6.50	76.00
	S. P. Davis, Little Rock, Ark.				
14383	Good Luck Brand	L. P. Abbe, Hazardville	6.78	6.50	87.00
14825	Good Luck Brand	Station Agent from E. M. Waller, Gaylordsville	6.49	6.50	82.00

TABLE II. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen.		Cost per ton.
			Found.	Guaranteed.	
	DeSoto Oil Co., Memphis.				
14529	104426	R. H. Osborne, Warehouse Point	6.66	6.58	$78.00
	E. St. Louis Cotton Oil Co., National Stock Yards, Ill.				
15021	R. I. 56053	C. D. Cannon, Windsor Locks	6.73	6.64	77.50
	W. D. Hall Co., Atlanta, Ga.				
14434	Good C. S. Meal	A. D. Ellsworth, Broad Brook	5.32	5.76	76.00
14618	Good C. S. Meal	Station Agent from A. E. Hall, Wallingford	5.89	5.76	80.00
	Oscar Holway, Auburn, Me.				
14887	N. Y. C. 214957	William Gilligan, Windsor	6.80	6.70	86.28
	Humphreys-Godwin Co., Memphis, Tenn.				
14941	Bull Brand,	P. T. McCue, Windsor Locks	6.98	6.87	82.00
15076	Bull Brand	Station Agent from E. Manchester & Sons, Winsted	7.16	6.87	85.00
15192	Bull Brand	J. A. Sherwood, Long Hill	7.09	6.87	83.00
15222	Bull Brand	C. L. Luce, New Britain	6.92	6.87	....
14659	Danish Brand	Station Agent from G. S. Phelps, Thompsonville	5.45	5.75	80.00
15133	Danish Brand	The Coles Co., Middletown	5.84	5.75	82.00
15187	Danish Brand	W. E. Wheelock, Quinebaug	5.81	5.75	....
14507	Dixie Brand, 89546	Hartford Tobacco Corporation, Hartford	7.49	7.50	94.75
15134	Bright C. S. Meal, Penn. 32253	Jno. Sullivan & Son, Thompsonville	5.49	5.76	72.00
15135	Bright C. S. Meal, L. V. 82216	Jno. Sullivan & Son, Thompsonville	5.67	5.76	72.00
15164	Bright C. S. Meal, C. & N. W. 101624	Spencer Bros., Suffield	5.54	5.76	73.00
15341	26206	Coles Co., Middletown	6.16	5.76	74.00
14784	Off-Color C. S. Meal, W. B. 45334	G. S. Phelps & Co., Thompsonville	5.67	5.75	68.00
14872	Off-Color C. S. Meal, Pa. 63451	Spencer Bros., Suffield	6.31	6.58	76.16
14901	Off-Color C. S. Meal, C. M. & St. P. 75860	Spencer Bros., Suffield	5.53	5.58	73.00
15145	Off-Color C. S. Meal, 246729	The Coles Co., Middletown	6.83	6.88	75.25
14386	Off-Grade C. S. Meal, A. T. & S. F. 31182	G. T. Soule, New Milford	6.26	6.27	76.10
14403	C. S. Meal, C. & O. 8803	The Coles Co., Middletown	6.00	5.75	83.00
14473	C. S. Meal, 111209	G. S. Phelps & Co., Thompsonville	5.92	5.75	67.00
14508	C. S. Meal, B. & M. 62922	L. B. Haas & Co., Hartford	7.34	7.50	93.75

TABLE II. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen.		Cost per ton.
			Found.	Guaranteed.	
	Humphreys-Godwin Co., Memphis, Tenn. (*Continued*).				
14530	Off-Grade C. S. Meal, P. M. 70929	S. J. Orr, West Suffield	6.44	..	$72.81
14531	Off-Grade C. S. Meal, M. O. P. 34509	S. J. Orr, West Suffield	6.59	..	74.49
14532	Off-Grade C. S. Meal, G. T. 25226	S. J. Orr, West Suffield	6.17	..	69.75
14533	Off-Grade C. S. Meal, G. E. T. 2125	S. J. Orr, West Suffield	6.19	..	69.94
14534	Off Grade C. S. Meal, C. C. C. & S. T. L. 53951	S. J. Orr, West Suffield	6.06	..	68.54
14535	Off-Grade C. S. Meal, N. Y. C. 255143	S. J. Orr, West Suffield	6.12	..	69.19
14556	Dark C. S. Meal, Chi., St. P. 28404	H. C. Nelson, West Suffield	5.77	5.75	66.00
15285	C. S. Meal, 101182	Coles Co., Middletown	5.76	5.76	78.00
	L. B. Lovitt & Co., Memphis, Tenn.				
14464	Off Color C. S. Meal, M. C. 60060	Spencer Bros., Suffield	6.99	7.13	80.15
14662	Off -Color C. S. Meal	O. T. Cone, Warehouse Point	7.56	7.20	88.95
14754	Off-Color C. S. Meal	J. B. Parker, Poquonock	7.63	..	79.39
14800	Off-Color C. S. Meal, N. P. 19112	Spencer Bros., Suffield	7.64	7.57	92.24
14810	Off-Color C. S. Meal, K. C. S. 12532	Spencer Bros., Suffield	7.66	7.92	90.11
14401	Off-Color C. S. Meal, P. R. R. 48725	Spencer Bros., Suffield	7.02	6.87	80.44
14431	Off-Color C. S. Meal, C. B. Q. 105732	Spencer Bros., Suffield	7.23	7.25	82.51
14432	Off-Color C. S. Meal, St. Fe 30995	Spencer Bros., Suffield	6.30	6.29	72.23
14433	Off-Color C. S. Meal, M. C. 46667	Spencer Bros., Suffield	6.92	6.99	79.30
14438	Off-Color C. S. Meal, I. C. 24343	Spencer Bros., Suffield	6.89	6.89	78.92
14439	Off-Color C. S. Meal, Penn. 35562	Spencer Bros., Suffield	6.89	6.68	78.92
14459	Off-Color C. S. Meal, F. W. D 4635	Spencer Bros., Suffield	6.19	6.39	71.00
14462	Off-Color C. S. Meal, I. & G. N. 5507	Spencer Bros., Suffield	6.69	6.58	76.69
14463	Off-Color C. S. Meal, S. L. & S. F. 40673	Spencer Bros., Suffield	6.36	6.35	72.89

Table II. Analyses of Cotton Seed Meal—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen.		Cost per ton.
			Found.	Guaranteed.	
	L. B. Lovitt & Co., Memphis, Tenn. (*Continued*).				
14469	Off-Color C. S. Meal, P. L. 535715	John Edgar, Enfield	6.85	6.85	$78.54
14470	Off-Color C. S. Meal, N. Y. C. 229466	Spencer Bros., Suffield	6.78	6.87	79.75
14528	Off-Color C. S. Meal, L. E. & W. 12215	Spencer Bros., Suffield	6.80	6.82	82.01
14550	Off-Color C. S. Meal, L. V. 85869	Spencer Bros., Suffield	6.74	6.82	81.32
14801	Off-Color C. S. Meal, B. & M. 47599	Spencer Bros., Suffield	6.87	6.81	82.92
14829	Off-Color C. S. Meal, L. & N 7607	Spencer Bros., Suffield	6.60	6.50	75.62
14494	Off-Color C. S. Meal, B. & O. 89651	Spencer Bros., Suffield	8.11	8.00	97.90
14586	Off-Color C. S. Meal, A. T. & S. Fe 7460	Spencer Bros., Suffield	8.07	8.27	97.41
	Lyle & Lyle, Huntsville, Ala.				
14384	Economy Brand Sou 120566	G. T. Soule, New Milford	5.92	5.75	85.00
	W. C. Nothern, Memphis.				
14377	Special No. 1, T. P. 8055	G. S. Phelps, Warehouse Point	6.75	6.50	77.00
14415	Off-Color, 120719	J. W. Crowell, Burnside	6.39	5.75	77.00
	Park & Pollard Co., Boston.				
14571	Upland C. S. Meal	Station Agent from F. B. Newton Est., Plainville	5.67	5.75	83.00
14297	Off-Color C. S. Meal	Rockville Milling Co	6.67	6.50	81.00
14335	B. & L. E. 81002	Ahern Bros., E. Windsor Hill	7.12	6.50	74.50
14337		L. C. Daly, Warehouse Point	7.16	6.50	78.00
14460	B. & O. 85534	Broad Brook Lumber & Coal Co.	7.26	7.43	83.79
14461	B-4 45144	Broad Brook Lumber & Coal Co.	7.03	7.28	81.13
14465	Off-Qual., C. C. C. & St. L. 9266	Station Agent from Broad Brook L. & C. Co	7.15	5.76	82.55
14500	G. T. 10102	E. H. Rollins, Granby	6.44	6.58	75.25
14504	L. & N. 3460	Broad Brook Lumber & Coal Co.	7.58	7.36	87.50
14505	C. of G. 60017	Broad Brook Lumber & Coal Co.	7.37	7.13	85.12
14630	S. S. W. 7320	E. H. Rollins, Granby	6.42	6.58	74.50
14826	Off-Grade	Station Agent from G. E. Ackley Co., New Milford	6.81	7.00	80.00
	The Roger & Hubbard Co., Middletown.				
14466	C. & O. 3223	Station Agent from P. F. Chamberlain, Broad Brook	6.75	6.50	82.00

TABLE II. ANALYSES OF COTTON SEED MEAL—(*Concluded*).

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. Nitrogen.		Cost per ton.
			Found.	Guaranteed.	
	Sanderson Ferts. & Chem. Co., New Haven.				
4509	....	Benjamin Fenn, Milford.........	6.71	..	....
	J. E. Soper & Co., Boston.				
4351	Puritan C. S. Meal.......	J. B. Cannon, Granby..........	6.09	5.75	$78.50
5189	Puritan C. S. Meal.......	The Coles Co., Middletown......	5.20	5.75	80.00
4661	Puritan C. S. Meal.......	Station Agent from P. Schwartz Co., New London.............	5.26	5.75	80.00
4493	Off-Color C. S. Meal......	Spencer Bros., Suffield..........	7.36	7.38	86.63
14497	Off-Color C. S. Meal, C. P. 205692...............	Spencer Bros., Suffield..........	7.40	7.22	84.78
14393	Off-Color C. S. Meal, 138752...............	L. C. Seymour, Windsor Locks...	5.10	5.76	74.00
14422	Off-Color C. S. Meal, 138752...............	Station Agent from L. C. Seymour	5.27	5.76	74.00
14831	....	H. F. Farnham, E. Windsor Hill.	6.25	5.76	75.00
14411	Off-Color C. S. Meal, N. P. 38946...............	W. E. Bates, East Granby.......	5.84	5.76	74.00
14799	....	C. H. Northam, Hartford......	5.49	5.76	77.00
14886	Off-Color C. S. Meal, Penn. 608298...............	J. T. O'Neill, Burnside..........	5.95	5.76	77.50
14870	Off-Color C. S. Meal......	Station Agent from A. Manning, So. Manchester..............	5.24	5.76	69.50
15091	Off-Color C. S. Meal......	Arthur Manning, Manchester....	5.42	5.76	69.50
	Taylor Commission Co., Atlanta, Ga.				
14728	....	Station Agent from Meech & Stoddard, Middletown...........	5.99	5.76	78.50
	Terrell Cotton Oil Co.				
14495	....	E. T. Hurlburt & Son, Somers...	7.16	6.75	87.50
	Texarkana Cotton Oil and Fertilizer Co., Texarkana, Ark.				
14416	....	Station Agent from E. N. Austin, Suffield....................	6.56	6.58	75.00
14511	....	Station Agent from Rockville Milling Co................	6.50	..	81.00
	Union Seed & Fert'z'r Co., New York.				
14609	Surety Brand C. S. Meal..	Station Agent from F. H. Rolf, Guilford....................	6.19	5.76	88.00
14938	Surety Brand, Erie 110567.	Coles Co., Middletown..........	5.84	5.76	84.00
14660	Amer. Red Tag C. S. Meal	Station Agent from M. E. Thompson, Ellington..............	6.31	6.18	80.00
15088	Amer. Red Tag C. S. Meal	J. E. Phelps, Suffield...........	6.35	6.18	70.10
	Jobber Unknown.				
14830	....	L. J. Prior, East Hartford........	6.59	..	....
15186	....	Arthur Manning, Manchester...	6.65	6.88	90.00

CASTOR POMACE.

Three samples were analyzed as follows:

14421. Sold by American Agricultural Chemical Co., New York City. Stock of E. N. Austin, Suffield.

14515. Sold by the Apothecaries Hall Co., Waterbury. Sampled at the factory.

14481. Sold by Baker Castor Oil Co., New York City. Stock of Olds & Whipple, Hartford.

Analyses of Castor Pomace.

Station No.	**14421**	**14515**	**14481**
Per cent. of			
Nitrogen guaranteed	4.50	4.52	4.50
Nitrogen found	5.29	5.73	5.72
Cost per ton	$60.00	$60.00	$57.00
Nitrogen costs per pound	**56.7**	**52.3**	**49.9**

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

BARIUM-PHOSPHATE.

14977. Grade A. Sold by Witherbee, Sherman & Co., Port Henry, N. Y. Stock of J. H. Miller, Stamford. Guaranteed 28 per cent. phosphoric acid.

14932. Grade B. Sold by Witherbee, Sherman & Co., Port Henry, N. Y. Stock of Geo. S. Carter, Clinton. Guaranteed 16 per cent. phosphoric acid. Cost $25.00 per ton.

14933. Grade C. Sold by Witherbee, Sherman & Co., Port Henry, N. Y. Stock of C. E. Lyman, Middlefield. Guaranteed 14 per cent phosphoric acid. Cost $22.00 per ton.

Analyses of Barium-Phosphate.

Station No.	**14977**	**14932**	**14933**
Water-soluble phosphoric acid	**None**	0.03	**None**
Citrate-soluble phosphoric acid	3.18	0.59	0.24
Insoluble phosphoric acid	25.16	16.68	16.21
Total phosphoric acid	28.34	17.30	16.45
Phosphoric acid cost cents per pound		**7.2**	**6.7**

RAW ROCK PHOSPHATE.

Two samples were analyzed as follows:

15181. Tacco Ground Phosphate. Sold by Tennessee Agricultural Corporation, Centerville, Tenn. Sent by E. E. Burwell, New Haven.

15150. Raw Ground Phosphate. Sold by Apothecaries Hall Co., Waterbury. Stock of H. A. Edwards, Naugatuck.

ANALYSES OF RAW ROCK PHOSPHATE.

Station No.	**15181**	**15150**
Water-soluble phosphoric acid	0.16	0.04
Citrate-soluble phosphoric acid	2.31	3.12
Citrate-insoluble phosphoric acid	21.25	28.06
Total phosphoric acid	23.72	31.22
"Available" phosphoric acid found	2.47	3.16
Cost per ton	....	$17.00

15181 was ground phosphate which had been saturated with strong liquid manure, worked over and exposed to the action of air and frost for a year.

PRECIPITATED BONE PHOSPHATE.

One sample was analyzed as follows:

14480. Sold by Olds & Whipple, Hartford. Sampled at factory. Cost $1.50 per unit available phosphoric acid.

ANALYSIS OF PRECIPITATED BONE PHOSPHATE.

Station No.	**14480**
Water-soluble phosphoric acid	0.37
Citrate-soluble phosphoric acid	18.67
Citrate-insoluble phosphoric acid	8.26
Total phosphoric acid	27.30
"Available" phosphoric acid found	19.04
Cost of "available" phosphoric acid per pound	**7.5¢**

BASIC LIME PHOSPHATE.

Two samples were analysed as follows:

15117. Sold by American Agricultural Chemical Co., New York City. Stock of R. E. Morgan, Windsor. Guaranteed 13 per cent. "available" phosphoric acid, 14 per cent. total phosphoric acid. Cost $24.25 f.o.b. factory.

14978. Basic Fruit and Legume Phosphate. Sold by Coe-Mortimer Co., New York City. Stock of J. C. Jackson, Wilton. Cost $22.75 per ton. Guaranteed 13 per cent. "available" phosphoric acid, 14 per cent. total phosphoric acid.

ANALYSES OF BASIC LIME PHOSPHATE.

Station No.	**15117**	**14978**
Water-soluble phosphoric acid	2.67	3.10
Citrate-soluble phosphoric acid	11.27	10.38
Citrate-insoluble phosphoric acid	1.50	1.46
Total phosphoric acid	15.44	14.94
"Available" phosphoric acid	13.94	13.48
Cost of "available" phosphoric acid per pound		**8.4¢**

DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

The analyses of twenty samples of this material are given in the table.

The prices charged have ranged from $27 to $40 per ton. The average cost of available phosphoric acid has been about 10.1 cents per pound.

Twenty samples were analyzed as follows:

14476. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled at factory.

14854. Sold by Piedmont-Mt. Airy Guano Co., Baltimore, Md. Stock of Farmers' Exchange, South Meriden.

15042. Sold by the Hubbard Fertilizer Co., Baltimore, Md. Stock of H. H. McKnight, Ellington.

15157. Sold by Olds & Whipple, Hartford. Stock of Haviland Tobacco Co., East Windsor Hill.

14707. Sold by National Fertilizer Co., New York City. Stock of R. Delaney, Somersville.

15207. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of D. L. Clarke & Sons, Milford.

14482. Sold by Olds & Whipple, Hartford. Sampled at factory.

14417. Sold by American Agricultural Chemical Co., New York City. Stock of E. N. Austin, Suffield.

TABLE III. ANALYSES OF ACID PHOSPHATE.

Station No.	Water-soluble phosphoric acid.	Citrate-soluble phosphoric acid.	Citrate-insoluble phosphoric acid.	Total phosphoric acid.	"Available" phosphoric acid found.	"Available" phosphoric acid guaranteed.	Cost per ton.	"Available" phosphoric acid costs cents per pound.
14476	15.39	1.79	0.15	17.33	17.18	16.00	$30.00	8.7
14854	12.17	3.13	1.01	16.31	15.30	16.00	27.00	8.8
15042	14.20	1.87	0.27	16.34	16.07	16.00	29.00	9.0
15157	13.71	3.22	0.93	17.86	16.93	16.00	30.87	9.1
14707	11.16	5.25	0.55	16.96	16.41	16.00	30.90	9.4
15207	14.34	3.27	0.33	17.94	17.61	16.00	33.50	9.5
14482	12.29	3.47	0.15	15.91	15.76	16.00	30.64	9.7
14417	14.64	2.20	0.19	17.03	16.84	16.00	33.00	9.8
14934	11.36	4.64	2.01	18.01	16.00	16.00	32.00	10.0
14542	12.67	2.62	1.64	16.93	15.29	16.00	32.00	10.4
14971	13.26	2.92	0.36	16.54	16.18	14.00	35.00	10.8
15074	12.01	3.70	1.52	17.23	15.71	16.00	34.00	10.8
14499	13.33	1.89	0.90	16.12	15.22	16.00	33.00	10.8
14514	14.02	1.94	0.20	16.16	15.96	14.00	35.00	11.0
14795	13.50	3.32	0.22	17.04	16.82	16.00	38.00	11.3
15113	13.58	2.90	0.32	16.80	16.48	16.00	40.00	12.1
14478	13.55	3.37	0.26	17.18	16.92	16.00	.....	....
14813	14.41	3.19	0.14	17.74	17.60	16.00	.....	....
14879	12.61	2.96	1.39	16.96	15.57	16.00	.....	..
14986	9.52	5.55	1.14	16.21	15.07	16.00	.....	....

The percentage of available phosphoric acid in Sample 14542, Royster's Acid Phosphate, was not so high as guaranteed. A second sample 14879 of the same brand contained a higher percentage of available acid than the first, but still did not fully meet its guaranty.

14934. Sold by Coe-Mortimer Co., New York City. Stock of J. E. Stoddard, Abington.

14542. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of J. R. Reinhard & Sons, West Cheshire.

14971. Sold by Listers Agricultural Chemical Works, Newark, N. J. Stock of W. H. Carrier, Glastonbury.

15074. Sold by Lowell Fertilizer Co., Boston, Mass. Stock of H. B. Brownson, Shelton.

14499. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

14514. Sold by American Agricultural Chemical Co., New York City. Stock of Spencer Bros., Suffield.

14795. Sold by Bowker Fertilzer Co., New York City. Stock of Geo. E. Ackley Co., New Milford.

15113. Sold by Listers Agricultural Chemical Works, Newark, N. J. Stock of B. C. Wooding, Yalesville.

14478. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

14813. Sold by Wilcox Fertilizer Co., Mystic. Sampled at factory.

14879. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of W. S. Brown, Trumbull.

14986. Sold by American Agricultural Chemical Co., New York City. Stock of W. H. Latimer & Son, Southington.

III. RAW MATERIALS OF HIGH GRADE CONTAINING POTASH.

COTTON HULL ASHES.

15171. Sent by Olds & Whipple, Hartford. Stock of Windsor Tobacco Growers' Corp., Windsor. It contained 19.42 per cent. of potash.

POTASH SALTS AND OTHER MATERIALS CONTAINING WATER-SOLUBLE POTASH.

14931. Kainit. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of Knowles, Lombard Co., Guilford. It contained 14.21 per cent. potash and cost $45.00 per ton, making the cost of actual potash 15.8 cents per pound.

14929. Muriate of potash. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of Knowles, Lombard Co., Guilford. It contained 56.68 per cent. potash and sold for $165 per ton, making the cost of actual potash 14.5 cents per pound.

14284. Nebraska Potash. Sold by Standard Potash Co., Lakeside, Neb. It contained 27.30 per cent. potash.

15023. Potash-Lime. Sent by Dexter Portland Cement Co., Nazareth, Pa. It contained 3.13 per cent. potash and 33.28 per cent. of lime.

IV. MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

FISH MANURES.

Sixteen samples were examined, eleven of which were sampled by the Station Agent and five by purchasers. Analyses appear in Table IV.

Sample **14585** was stated to be bought by Mr. Fiske for his own use from the New England Fertlizer Co. It is not a brand registered by them.

Three of the samples, **15125**, Lowell Fertilizer Co.; **15114**, Atlantic Packing Co.; and **15136**, A. L. Koster, contained much less nitrogen than was guaranteed.

The average percentage of nitrogen, though with a wide range, is about 8.33; of available phosphoric acid, 6.01; and the cost per ton, ranging from $80 to $115, has averaged about $99.64.

Allowing 10 cents per pound for available phosphoric acid, the nitrogen in fish manures has had an average cost of 52.6 cents per pound.

TABLE IV. ANALYSES OF

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.
	Sampled by Station:	
14418	American Agr. Chem. Co.	E. N. Austin, Suffield
14645	Apothecaries' Hall Co	Wm. Reeves, Windsorville
15114	Atlantic Packing Co.	John Helm, So. Windsor
14574	Berkshire Fertz. Co.	Manufacturer
14989	East Harbor Fertz. Co.	Wybern Farms, Melrose
15130	A. L. Koster	Michael Cannon, Rockville
15125	Lowell Fertz. Co.	T. J. Coleman, Warehouse Pt.
14585		W. E. Fiske, Warehouse Pt.
14537	Olds & Whipple	Manufacturer
14930	F. S. Royster Guano Co.	C. R. Woodford & Sons, Avon
14644	Wilcox Fertz. Co.	Bloomstein & Adler, Burnside
	Sampled by Purchaser:	
15183[3]	"Fish Meal," East Coast Fisheries Products Co.	American Sumatra Tobacco Co., East Hartford
15136	A. L. Koster	Fassler & Silberman, Hartford
14238	Wilcox Fertz. Co.	American Sumatra Tobacco Co., East Hartford
14346	No. 2	Silverherz Tobacco Co., Rockville
14345	No. 1	Silverherz Tobacco Co., Rockville

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[1] 0.39 per cent. nitrogen in nitrates.

[2] 0.16 per cent. nitrogen in nitrates.

[3] Contains 0.76 per cent. chlorine.

SLAUGHTER HOUSE TANKAGE.

Table V, page 28.

Fifteen samples were examined. Six of these were sampled by the Station Agent, seven were submitted by purchasers, and two by a manufacturer for determinations of nitrogen availability. **14062**, Tankage base, prepared from slaughter-house tankage, contained 1.64 per cent. of water-insoluble organic nitrogen, 78.2 per cent. of which was in active form. **14063**, Bone Tankage, contained 2.79 per cent. of water-insoluble organic nitrogen, 87.0 per cent. of which was in active form. The neutral permanganate method was employed in both cases.

Analyses of the remaining samples appear in Table V.

One of the samples taken by the Station Agent, **15204**, Atlantic Packing Co., was far below its guaranty in nitrogen and phosphoric acid, and four others, **14475** and **14881**, Conn. Fat Rendering and Fertilizing Corp., **14855**, Piedmont-Mt. Airy Guano Co., and **14918**, M. L. Shoemaker & Co., were deficient in phosphoric acid.

FISH MANURES.

Nitrogen.				Phosphoric acid.			Total phosphoric acid.		
As ammonia.	As organic.	Total found.	Total guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Cost per ton.
0.23	8.92	9.15	8.23	....	....	....	8.66	6.00	$100.00
0.17	8.81	9.37[1]	8.20	0.50	5.92	1.52	7.94	5.50	115.00
0.18	7.28	7.46	7.81	0.50	5.31	0.43	6.24	5.50	80.00
0.60	7.69	8.29	8.23	0.75	4.52	0.95	6.22	6.00	100.00
0.52	8.48	9.00	8.23	0.70	3.78	0.91	5.39	6.00	95.00
3.90	5.13	9.03	8.23	0.33	5.85	1.60	7.78	3.00	.....
0.21	7.08	7.29	7.81	0.51	4.86	0.23	5.60	5.50	100.00
0.26	7.67	7.93	7.41	0.43	4.93	0.38	5.74	14.00	105.00
0.20	7.85	8.05	8.23	0.57	8.99	4.45	14.01	5.50	99.75
0.23	8.28	8.51	8.22	0.35	7.77	4.03	12.15	5.00	106.00
0.66	7.96	8.78[2]	8.24	1.56	4.49	0.77	6.82	5.00	.....
0.15	9.09	9.24	....	0.58	8.92	3.08	12.58	....	.....
1.16	5.13	6.29	8.23	0.50	6.40	0.58	7.48	3.00	96.00
0.46	8.10	8.56	....	2.38	2.35	0.83	5.56	....	.....
0.20	7.74	7.94	....	0.50	5.82	5.32	11.64	....	.....
0.92	7.78	8.70	....	1.23	4.51	1.33	7.07	....	.....

TABLE V. ANALYSES OF

Station No.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station:	
14486	Apothecaries Hall Co.	R. H. Morgan, West Cheshire
15204	Atlantic Packing Co.	Manufacturer
14475	Conn. Fat Rend. & Fertz. Corp.	Manufacturer
14881	Conn. Fat Rend. & Fertz. Corp.	F. A. Forbes, East Haven
14855	Piedmont—Mt. Airy Guano Co.	Minor Ives, South Meriden
14918	M. L. Shoemaker & Co.	H. B. Cornwall, Meriden
	Sampled by Purchaser:	
15188	Apothecaries Hall Co.	Barnes Bros. Nursery Co.
14344		Chas. Johnson, Gaylordsville
15389	Apothecaries Hall Co.	A. N. Pierson, Inc., Cromwell
15382	Godfrey Fertilizer & Chem'l Co., Newark, N.J.	A. N. Pierson, Inc., Cromwell
15383	Godfrey Fertilizer & Chemical Co., Newark, N. J.	A. N. Pierson, Inc., Cromwell
15384	Godfrey Fertilizer & Chemical Co., Newark, N. J.	A. N. Pierson, Inc., Cromwell
15774	Godfrey Fertilizer & Chemical Co., Newark, N. J.	A. N. Pierson, Inc., Cromwell

[1] 0.16 per cent. nitrogen in nitrates.

BONE MANURES.

Table VI, page 30.

The analyses of 19 samples, of which 15 were drawn by the Station Agent, are given in table VI.

14420 is not a brand registered in this State, but is stated to have been shipped by mistake to E. N. Austin by the Springfield Rendering Co., Springfield, Mass.

One sample, **15065**, from the Piedmont-Mt. Airy Guano Co., failed to meet its guaranty of nitrogen.

The average amounts of nitrogen and phosphoric acid found in these samples have been 3.43 and 23.45 per cent. respectively, and the average cost, ranging from $51.50 to $76, has been $63.15. Allowing 50 cents per pound for nitrogen, phosphoric acid has cost 6.1 cents.

GARBAGE TANKAGE.

14696 is tankage prepared from city garbage. Sent by the Health Dept., Bridgeport. It contained 2.30 per cent. of nitrogen and 3.30 per cent. of phosphoric acid. 78 per cent. of the material was in particles coarser than 1-50 inch.

SLAUGHTER HOUSE TANKAGE.

Nitrogen.				Phosphoric acid.		Mechanical analysis.		
As ammonia.	As organic.	Total found.	Total guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.
0.14	5.55	5.69	5.79	16.49	15.00	33.00	67.00	$65.00
0.61	.....	3.95	4.93	4.73	14.00	51.00	49.00	56.50
0.54	2.94	3.48	3.23	22.88	25.42	47.00	53.00	40.00
0.18	3.09	3.27	3.23	22.98	25.42	41.00	59.00	45.00
0.16	4.70	4.86	4.93	10.82	13.73	49.00	51.00	57.00
0.10	7.31	7.57[1]	7.40	9.81	15.00	65.00	35.00	75.50
0.23	5.82	6.05	6.34	14.24	12.20	34.00	66.00	60.49
0.12	7.02	7.14	.....	11.82	......	.....	.....	......
.....	.....	3.23	.....	25.57	......	.....	.....	......
.....	.....	3.92	.....	5.54	......	.....	.....	......
.....	.....	4.46	.....	12.45	......	.....	.....	......
.....	.....	4.23	.....	10.93	......	.....	.....	......
0.30	4.20	4.50	4.84	10.67	12.00	.....	.....	......

MIXED BONE AND TANKAGE.

14866. Listers Celebrated Ground Bone and Tankage Acidulated, made by Listers Agricultural Chemical Works, Newark, N. J. Stock of S. J. Orr, West Suffield; cost $54 per ton.

PERCENTAGE COMPOSITION OF MIXED BONE AND TANKAGE.

Total nitrogen found	2.81
Total nitrogen guaranteed	2.67
Total phosphoric acid found	13.42
Total phosphoric acid guaranteed	12.00

AVERAGE COST OF PLANT FOOD IN FERTILIZER MATERALS

From the foregoing analyses of the various fertilizing materials sold in Connecticut during the present year, the following statement is prepared showing what has been the approximate average cost per pound of nitrogen, phosphoric acid and potash:

TABLE VI. ANALYSES OF

Station No.	Manufacturer and Brand.	Dealer or Purchaser.
	Sampled by Station:	
15056	Am. Agr. Chem. Co., Fine Ground Bone..	Spencer Bros., Suffield...........
15060	Atlantic Packing Co., Fine Bone Meal...	T. H. Eldredge, Norwich..........
15062	Berkshire Fertz. Co., Fine Ground Bone..	Manufacturer....................
15057	Bowker Fertz. Co., Fresh Ground Bone..	Israel Andrews, Milldale.........
15063	Coe-Mortimer Co., Fine Ground Bone...	Morrison & Dunham, Bethel.......
15055	L. T. Frisbie Co., Fine Bone Meal.......	Stanley Svea Coal Co., New Britain
15064	Lowell Fertz. Co., Ground Bone 2½—26.	S. T. Welden, Simsbury..........
14420	Manchester Rendering Co., Manchester, New Hampshire....................	E. N. Austin, Suffield............
15061	Pawtucket Ren. Co., Ground Bone.......	Chas. A. Templeton, Inc., Waterbury
15065	Piedmont–Mt. Airy Guano Co., Bone Meal	Farmers' Exchange, Woodstock...
15058	Rogers & Hubbard Co., Strictly Pure Fine Bone..........................	Joseph Kincaid, Jr., Middletown
15124	Rogers & Hubbard Co., Pure Raw Knuckle Bone Flour......................	Cadwell & Jones, Hartford......
15053	Sanderson Fertz. & Chem. Co., Fine Ground Bone......................	Manufacturer....................
15054	M. L. Shoemaker, Swift-Sure Bone Meal.	Olds & Whipple, Hartford.........
15059	Worcester Rendering Co., Prosperity..... Royal Worcester Ground Steamed Bone	.... G. M. Williams Co., New London
	Sampled by Purchaser.	
15209	Armour Fertz. Co., Bone Meal..........	Horace Homer, Cos Cob..........
14298	Berkshire Fertz. Co., Bone Meal........	A. T. Henry, Wallingford.........
14341	L. T. Frisbie Co., Pure Fine Ground Bone	A. E. Plant Son's Co., Branford....
14396	....	John H. Gasser, Bethel............

	Cents per pound.
Nitrogen in nitrates............................	25.6
sulphate of ammonia.....................	23.6
cotton seed meal.........................	54.5* to 61.2
castor pomace............................	48.6* to 52.8
fish....................................	52.5†
Total phosphoric acid in raw ground rock...........	2.7
in "barium-phosphate".......	6.7 to 7.2
bone.......................	6.1§
Available phosphoric acid in precipitated phosphate..	7.5
basic lime phosphate.......	8.4
acid phosphate............	10.1
Potash..	(about) 16.0

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* Allowing 7 cents and 12 cents, respectively, for the phosphoric acid and potash contained in it.

† Allowing 10.1 cents per pound for available phosphoric acid.

§ Allowing 50 cents per pound for the nitrogen.

BONE MANURES.

Nitrogen.		Phosphoric acid.		Mechanical analysis.		
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.
3.64	2.47	23.16	22.88	40	60	$58.00
2.72	2.05	26.38	25.00	62	38	63.00
4.20	3.30	20.24	20.00	46	54	60.00
2.59	2.47	26.17	22.88	64	36	61.00
2.51	2.47	25.13	22.83	69	31	60.00
3.24	2.47	26.02	20.00	48	52	64.00
3.32	2.05	24.82	27.00	43	57	52.00
2.85	2.50	25.38	26.00	52	48	.....
3.98	2.47	21.36	20.00	59	41	65.00
1.94	2.47	22.29	20.00	51	49	.....
3.67	3.29	23.41	20.59	60	40	73.00
3.84	3.82	24.69	24.70	76	24	76.00
3.39	2.47	23.67	22.88	45	55	51.50
4.72	4.53	24.69	20.00	65	35	70.00
2.90	2.47	23.97	20.00	54	46	68.00
2.18	....	27.03	.....	47	53	.....
4.63	4.11	18.86	.....	..	..	.....
3.57	2.47	24.46	20.00	44	56	.....
4.04	....	17.49	.....	..	..	60.00

It appears that mineral forms of nitrogen, in nitrates and sulphate of ammonia, have cost only half as much as in most organic forms. There is no question that they are more quickly and completely available than other forms, and under most conditions more economical to use at the present time. Moreover, in comparison with organic forms, they will have to be used in relatively larger amounts in the future. Organic materials, tankage, fish, cotton seed meal, and even bone to a smaller extent, are being used more and more as cattle feeds. Their prices have greatly increased and the supply for fertilizers greatly diminished.

In the brands of mixed fertilizers sold in the State, mineral forms of nitrogen in 1890 made 21.5 per cent. of the total nitrogen; in 1900, 22 per cent.; in 1910, 41 per cent.; and in 1919, 49 per cent.

Other forms of mineral nitrogen, such as nitrate of ammonia, nitrate of lime and phosphate of ammonia, obtained by the fixation of atmospheric nitrogen, will doubtless be put on the market in the near future.

The Stations and the users of fertilizers have the problem of determining which forms of mineral nitrogen are the most convenient and economical for use, mixed or unmixed, on our various crops.

V. MIXED FERTILIZERS.

NITROGENOUS SUPERPHOSPHATES WITHOUT POTASH.

In the following table are analyses of 92 samples, 89 of which were drawn by the Station Agent by the methods prescribed by law.

COMPOSITION AND COST OF THE BRANDS.

4 samples have a guaranty of .82 per cent. nitrogen.
16 " " " " " 1.65 " "
8 " " " " " 2.47 " "
21 " " " " " 3.25 " "
28 " " " " " 4.11 " "
12 " " " still higher nitrogen guaranty.
—
89

This year 68% of the brands had 3.25 per cent. or more of nitrogen (equivalent to 4 per cent. ammonia). Last year the percentage was 58. This indicates that in general the brands sold this year have been of higher grade than last year. The National Fertilizer Association has urged on manufacturers the abandonment of low grade brands, and the Station has repeatedly pointed out the false economy of buying "cheap" or low grade goods.

The question for the buyer to decide is not what brands are cheapest, but in what brands available nitrogen, phosphoric acid and potash can be most cheaply bought.

The following average figures are taken from the table of analyses:

GUARANTY.			
Nitrogen.	Available Phos. acid.	Cost per ton.	With available phos. acid worth 10 cents per lb. nitrogen costs, cents per lb.
0.82	10	$46.00	158.0
1.65	10	48.03	84.9
2.87	10	52.97	66.7
2.57	10	55.65	62.1
3.29	10	58.61	58.7
4.11	8	61.75	55.6

The lowest priced brand, .82-10, sells for $46, and the nitrogen in it costs over $1.50 per pound.

The highest priced brand, 4.11-8, sells for $61.75, but the nitrogen in it costs only about one-third as much as it does in the lowest priced brand.

GUARANTIES.

Two of the brands examined were deficient in nitrogen, 13 in available phosphoric acid, and 7 in both of these ingredients.

In most cases, however, a deficiency of one ingredient was made up in money equivalent by an overrun of the other ingredient.

Nine samples, however, failed to thus make good the money equivalent by the amounts named below, available phosphoric acid being valued at 10 cents and nitrogen at 50 cents per pound.

15119	A. A. C. Co.'s Special Vegetable Fertilizer	$3.30
15025	Armour's 4-10-0	3.80
14751	Atlantic Packing Co.'s 4-8	1.92
14546	Frisbie's 2-8	1.46
14651	" 5-8	5.62
15078	Lowell Fertz. Co.'s Tobacco 5-6	3.52
15010	Parmenter & Polsey Fertzr. Co.'s Tobacco 5-4	2.18
14945	Piedmont-Mt. Airy Guano Co.'s Brown's Special Fertilizer	6.88
14610	Royster Guano Co.'s Landmark	3.40

QUALITY OF THE NITROGEN.

The solubility of the organic nitrogen has been determined in all samples, and in no case was evidence found of the presence of inferior ammoniates.

ANALYSES NEEDING SPECIAL NOTICE.

14651. Frisbie's 5-8 was below its guaranteed composition in both nitrogen and "available" phosphoric acid. The firm wrote that it would endeavor to adjust the shortage with the purchaser, and believing that the analysis did not represent the average quality of the goods, asked that another sample be drawn. This was done and analysis No. **15163** of the same brand fully met the guaranty.

14610. Royster's Landmark was also below the guaranteed composition in both nitrogen and "available" phosphoric acid.

The firm asked to have another sample analyzed, but the sampling agent was unable to find it in stock in the state.

TABLE VII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.
	Sampled by Station:	
	American Agricultural Chem. Co., New York City.	
14949	Ammoniated Fertilizer A	North Haven
14794	Ammoniated Fertilizer AA	New Canaan
14952	Ammoniated Fertilizer AAA	Southport
14525	Ammoniated Fertilizer AAAA	Southport
14875	Ammoniated Fertilizer AAAA	New Haven
15115	Five Eight Fertilizer	Windsor
15119	*Special Vegetable Fertilizer	Rockville
14862	Tobacco Special	Simsbury
14688	Bradley's Special Corn Phosphate without Potash	Norwich
14689	Bradley's Special Potato Fertz. without Potash	Norwich
	Apothecaries Hall Co., Waterbury, Conn.	
14957	Liberty Corn, Fruit and All Crops	Waterbury
14796	Liberty Market Gardeners' Special	Cheshire
14958	Liberty Potato and Vegetable Special	Waterbury
14747	Liberty Tobacco Special	Windsorville
14858	Liberty Top Dresser for Grass and Grain	Waterbury
	Armour Fertilizer Works, Chrome, N. J.	
15025	*4-10-0	Waterbury
	Atlantic Packing Co., New Haven, Conn.	
14797	Atlantic 2-8	New Britain
14751	*Atlantic 4-8	Norwich
	Berkshire Fertilizer Co., Bridgeport, Conn.	
14873	Economical Grass Fertilizer	Ellington
15024	Grass Special	Chester
14792	Long Island Special	Milford
14590	Tobacco Grower	Ellington
14904	Tobacco Starter	Suffield
	F. E. Boardman, Middletown, Conn.	
14859	Fertilizer for General Crops	Middletown
	Bowker Fertilizer Co., New York City.	
15035	Superphosphate with Ammonia 2%	Watertown
14597	Superphosphate with Ammonia 3%	Milldale
14744	Superphosphate with Ammonia 4%	Milldale
14909	Superphosphate with Ammonia 5%	South Manchester
14640	Tobacco Grower	Thompsonville

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* See note, page 33.

WITHOUT POTASH

price per ton	Nitrogen.						Phosphoric Acid.							
	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		Station No.
					Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	
.00	none	0.26	0.37	0.41	1.04	0.82	7.50	3.24	0.82	11.56	11.00	10.74	10.00	14949
.00	0.17	0.54	0.63	0.87	2.21	1.65	4.27	5.53	1.45	11.25	11.00	9.80	10.00	14794
.00	0.18	0.85	0.25	1.39	2.67	2.47	5.94	4.30	1.32	11.56	11.00	10.24	10.00	14952
.00	0.55	0.66	0.86	1.60	3.67	3.29	6.00	3.62	2.85	12.47	11.00	9.62	10.00	14525
.00	0.52	0.67	0.80	1.58	3.57	3.29	5.89	4.10	2.61	12.60	11.00	9.99	10.00	14875
..	1.58	0.12	1.30	1.50	4.50	4.11	4.86	3.75	1.93	10.54	9.00	8.61	8.00	15115
.00	1.15	1.00	0.04	0.83	3.02	3.29	5.89	3.81	1.39	11.09	11.00	9.70	10.00	15119
.25	1.20	0.04	0.09	3.03	4.36	4.11	1.08	3.84	0.27	5.19	5.00	4.92	4.00	14862
.00	none	0.45	0.47	0.92	1.84	1.65	5.84	4.40	2.53	12.77	11.00	10.24	10.00	14688
.00	0.13	0.46	0.18	0.99	1.76	1.65	6.36	3.98	2.53	12.87	11.00	10.34	10.00	14689
.20	none	0.33	0.73	0.84	1.90	1.65	7.23	3.06	1.30	11.59	11.00	10.29	10.00	14957
..	none	1.67	0.44	1.27	3.38	3.29	8.97	2.54	0.14	11.65	11.00	11.51	10.00	14796
.60	none	1.09	0.67	0.80	2.56	2.47	8.69	2.59	0.78	12.06	11.00	11.28	10.00	14958
.20	0.19	0.87	0.13	3.13	4.32	4.11	3.06	1.87	0.55	5.48	5.00	4.93	4.00	14747
.50	0.12	3.02	0.42	1.40	4.96	4.94	6.99	1.83	0.72	9.54	9.00	8.82	8.00	14858
.00	0.10	1.28	0.33	1.17	2.88	3.29	7.91	2.24	1.18	11.33	10.50	10.15	10.00	15025
.00	0.07	0.54	0.43	0.59	1.63	1.64	4.38	3.42	0.29	8.09	9.00	7.80	8.00	14797
9.75	0.57	0.98	0.69	1.10	3.34	3.28	3.32	3.42	1.83	8.57	9.00	6.74	8.00	14751
2.50	5.62	0.66	0.45	0.53	7.26	7.40	2.23	3.65	0.61	6.49	8.00	5.88	4.00	14873
2.00	2.46	0.99	1.21	0.47	5.13	5.00	2.69	1.85	0.45	4.99	5.00	4.54	4.00	15024
6.50	1.80	0.18	0.27	1.26	3.51	3.30	3.04	5.43	0.61	9.08	9.00	8.47	8.00	14792
0.50	0.34	0.54	0.31	3.32	4.51	4.11	1.27	3.90	0.13	5.30	4.00	5.17	4.00	14590
...	3.05	0.46	0.40	1.38	5.29	5.00	1.37	3.52	0.33	5.22	5.00	4.89	4.00	14904
0.00	1.25	0.58	0.08	1.70	3.61	3.29	3.17	3.86	0.97	8.00	...	7.03	7.00	14859
7.00	0.22	0.20	0.32	0.97	1.71	1.65	5.18	4.85	1.75	11.78	11.00	10.03	10.00	15035
4.75	none	1.04	0.27	1.50	2.81	2.47	6.46	3.72	1.70	11.88	11.00	10.18	10.00	14597
0.75	0.97	1.22	0.09	1.28	3.56	3.29	6.55	3.94	1.19	11.68	11.00	10.49	10.00	14744
...	0.89	1.07	0.60	1.71	4.27	4.11	8.04	2.69	1.01	11.74	9.00	10.73	8.00	14909
0.00	0.72	0.53	none	3.16	4.41	4.11	1.42	3.88	0.20	5.50	5.00	5.30	4.00	14640

TABLE VII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling
	Sampled by Station:	
	E. D. Chittenden Co., Bridgeport, Conn.	
14906	Complete Tobacco & Onion Grower without Potash	Suffield
14908	Tobacco Special without Potash	Enfield
14976	Vegetable and Onion Grower without Potash	Greens Farms
	E. B. Clark Seed Co., Milford, Conn.	
14815	Special Mixture for General Use	Milford
	The Coe-Mortimer Co., New York City.	
14775	Gardeners' and Truckers' Special 1916	Greenwich
14814	High Grade Ammoniated Superphosphate 1916	Milford
14774	Prolific Crop Producer 1916	Greenwich
14973	Tobacco Special	South Windsor
	The Essex Fertilizer Co., Boston, Mass.	
14914	3½–10	Wallingford
15083	Tobacco 5–6	East Granby
	The L. T. Frisbie Co., New Haven, Conn.	
14546	*2–8	New Britain
14913	5–6	Glastonbury
14651	*5–8	East Hartford
15163	5–8	Branford
	The Hubbard Fertilizer Co., Baltimore, Md.	
15044	4–10–0	Ellington
	International Agricultural Corp., Buffalo, N. Y.	
14772	Buffalo Ammoniated Phosphate	Ansonia
14863	Buffalo Three Ten	Tariffville
15128	Buffalo Tobacco Grower	West Suffield
14820	Buffalo Tobacco Special	East Granby
15009	Buffalo Top Dresser and Starter	East Granby
14821	I. A. C. Tobacco Crop	Tariffville
	Lister's Agricultural Chemical Works, Newark, N. J.	
14823	Plant Food 1916	Danbury
14822	Superior Ammoniated Superphosphate 1916	Danbury
	Lowell Fertilizer Co., Boston, Mass.	
15082	3½–10–0	Bloomfield
14943	5–8	Wallingford
15051	Dissolved Bone Fertilizer 2–10	Shelton
15078	*Tobacco 5–6	South Manchester

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*See note, page 33.

WITHOUT POTASH—(*Continued*).

	Nitrogen.						Phosphoric Acid.							
	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		Station No.
					Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	
	1.37	1.01	0.08	0.67	3.13	3.29	9.46	1.38	0.20	11.04	11.00	10.84	10.00	149
00	2.14	0.06	0.18	2.09	4.47	4.11	4.14	1.60	0.32	6.06	5.00	5.74	4.00	149
.	1.33	0.52	none	0.64	2.49	2.47	7.32	3.38	0.79	11.49	11.00	10.70	10.00	149
00	0.10	2.40	0.14	0.84	3.48	3.29	8.15	2.17	0.64	10.96	10.50	10.32	10.00	148
75	0.97	1.80	0.37	1.07	4.21	4.11	4.57	3.82	0.87	9.26	9.00	8.39	8.00	147
00	none	1.06	0.26	1.22	2.54	2.47	6.82	3.87	1.54	12.23	11.00	10.69	10.00	148
00	0.82	1.07	0.51	0.95	3.35	3.29	6.78	3.58	1.20	11.56	11.00	10.36	10.00	147
. .	none	0.06	1.29	2.85	4.20	4.11	1.02	4.00	0.15	5.17	5.00	5.02	4.00	149
00	0.13	1.18	0.47	1.02	2.80	2.87	6.03	3.83	0.78	10.64	11.00	9.86	10.00	149
00	0.98	0.08	0.88	1.72	3.66	4.11	1.77	3.24	2.06	7.07	7.00	5.01	6.00	150
00	none	0.48	0.59	0.58	1.65	1.65	4.20	3.07	0.37	7.64	9.00	7.27	8.00	145
00	1.09	0.07	0.84	1.61	3.61	4.10	2.51	3.23	2.15	7.89	7.00	5.74	6.00	149
75	1.24	0.10	0.81	1.50	3.65	4.10	2.93	4.51	2.92	10.36	9.00	7.44	8.00	146
75	0.78	1.74	1.82		4.34	4.10	4.85	3.21	0.31	8.37	9.00	8.06	8.00	151
..	1.59	none	1.01	0.47	3.07	3.28	9.35	1.96	0.43	11.74	11.00	11.31	10.00	150
.00	0.39	0.07	0.63	0.51	1.60	1.60	8.63	3.80	1.68	14.11	13.00	12.43	12.00	147
.50	0.79	0.07	0.76	0.74	2.36	2.50	4.45	6.19	1.33	11.97	11.00	10.64	10.00	148
..	1.98	none	0.56	1.50	4.04	4.10	1.69	3.02	0.46	5.17	5.00	4.71	4.00	151
.42	1.62	0.06	0.21	1.33	3.22	3.30	1.34	2.46	0.90	4.70	4.00	3.80	3.00	148
..	0.37	1.91	1.51	1.86	5.65	5.80	4.03	2.54	1.39	7.96	7.00	6.57	6.00	150
.75	2.19	0.07	0.49	1.33	4.08	4.10	2.53	2.53	1.27	6.33	5.00	5.06	4.00	148
.00	none	0.11	0.38	0.44	0.93	0.82	7.21	3.32	0.93	11.46	11.00	10.53	10.00	148
.75	1.06	1.26	0.35	0.84	3.51	3.29	7.00	2.95	1.61	11.56	11.00	9.95	10.00	148
.00	0.12	0.84	0.91	1.03	2.90	2.87	7.20	3.70	2.00	12.90	11.00	10.90	10.00	150
..	0.74	1.38	0.91	1.16	4.19	4.10	5.59	3.41	0.70	9.70	9.00	9.00	8.00	149
.	0.16	0.62	0.39	0.60	1.77	1.64	4.32	4.64	1.29	10.25	11.00	8.96	10.00	150
.00	1.28	none	0.92	1.54	3.74	4.10	2.12	2.92	2.12	7.16	6.00	5.04	5.00	150

TABLE VII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.
	Sampled by Station:	
	The Mapes Formula and Peruvian Guano Co., New York City.	
14741	General Crop 1916	Windsor Locks
	National Fertilizer Co., New York City.	
14588	5–4 Tobacco Manure	South Manchester
14516	Nitrogen Phosphate Mixture No. 1	Guilford
14540	Nitrogen Phosphate Mixture No. 2	Guilford
14652	Nitrogen Phosphate Mixture No. 3	Silver Lane
14740	Nitrogen Phosphate Mixture No. 4	Guilford
	New England Fertilizer Co., Boston, Mass.	
14833	3½–10	Hamden
14643	Tobacco 5–4	Warehouse Point
	Olds & Whipple, Hartford, Conn.	
15148	Grass Fertilizer	Hartford
14840	High Grade Tobacco Starter	Simsbury
15156	High Grade Tobacco Starter	East Windsor Hill
14990	Tobacco Special Fertilizer	Hartford
14709	Tobacco Special Fertilizer	East Windsor Hill
	Parmenter and Polsey Fertilizer Co., Boston, Mass.	
15077	2–10	Plainville
14839	3½–10	Rocky Hill
15010	*Tobacco 5–4	Glastonbury
	Piedmont-Mt. Airy Guano Co., Baltimore, Md.	
14945	*Brown's Special Fertilizer	Woodstock
	F. S. Royster Guano Co., Baltimore, Md.	
14610	*Landmark	Waterbury
14880	Perfecto Tobacco Formula	Granby
14727	Prime Fish Brand	Shelton
15004	Purity	Plantsville
15127	Stevens' Formula	Glastonbury
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.	
14776	High Grade Ammoniated Phosphate	Highwood
14573	Phosphate without Potash	New Haven
14923	Special without Potash	Middlefield
14718	Tobacco Grower	East Hartford
14581	Top Dressing for Grass and Grain wihout Potash	Milford
14635	Top Dressing for Grass and Grain without Potash	Meriden

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* See note, page 33.

WITHOUT POTASH—(*Continued*).

Dealer's cash price per ton.	Nitrogen.						Phosphoric Acid.							
	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available".		Station No.
					Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	
6.00	0.93	0.07	0.09	0.72	1.81	1.65	4.73	3.71	2.38	10.82	10.00	8.44	8.00	**14741**
0.50	1.17	0.07	0.07	2.78	4.09	4.11	1.08	4.66	0.38	6.12	5.00	5.74	4.00	**14588**
5.00	none	0.23	0.56	0.37	1.16	0.82	7.65	4.03	0.73	12.41	11.00	11.68	10.00	**14516**
0.00	none	0.42	0.86	0.74	2.02	1.65	5.80	4.29	1.16	11.25	11.00	10.09	10.00	**14540**
. ..	0.71	0.60	0.61	1.59	3.51	2.47	6.12	3.75	2.35	12.22	11.00	9.87	10.00	**14652**
5.00	0.55	0.67	0.67	1.63	3.52	3.29	5.72	4.30	2.49	12.51	11.00	10.02	10.00	**14740**
5.00	0.15	0.81	0.65	1.29	2.90	2.87	6.71	3.59	2.72	13.02	11.00	10.30	10.00	**14833**
2.00	0.64	0.45	0.79	1.52	3.40	4.10	0.86	2.34	1.34	4.54	5.00	3.20	4.00	**14643**
1.27	2.88	0.12	0.81	1.74	5.55	4.95	3.42	5.64	0.82	9.88	8.00	9.06	8.00	**15148**
1.25	3.23	0.21	0.20	4.59	8.23	8.23	2.28	2.17	0.46	4.91	3.00	4.45	3.00	**14840**
7.38	..	..	...	...	8.04	8.23	...	...	...	5.65	3.00	...	...	**15156**
...	0.86	0.11	0.11	3.25	4.33	4.11	2.10	3.14	0.41	5.65	4.00	5.24	4.00	**14990**
...	0.66	0.11	none	3.63	4.40	4.11	0.73	5.28	0.58	6.59	4.00	6.01	4.00	**14709**
0.00	0.20	0.25	0.49	0.64	1.58	1.64	6.85	3.42	1.50	11.77	11.00	10.27	10.00	**15077**
5.60	0.16	0.81	0.29	1.68	2.94	2.87	6.84	3.27	2.85	12.96	11.00	10.11	10.00	**14839**
4.50	1.35	0.11	0.94	1.56	3.96	4.10	0.63	2.98	1.56	5.17	5.00	3.61	4.00	**15010**
9.50	1.08	0.21	0.59	0.61	2.49	3.29	7.07	3.49	1.20	11.76	...	10.56	10.00	**14945**
0.00	0.21	1.40	0.25	1.23	3.09	3.29	6.88	2.42	1.54	10.84	10.50	9.30	10.00	**14610**
73.00	0.37	0.63	0.07	2.43	3.50	4.11	3.04	1.94	0.41	5.39	4.50	4.98	4.00	**14880**
5.00	0.42	0.64	0.03	0.62	1.71	1.65	5.64	2.36	0.88	8.88	8.50	8.00	8.00	**14727**
....	0.08	0.43	none	0.49	1.00	0.82	4.41	3.70	0.92	9.03	8.50	8.11	8.00	**15004**
....	0.44	0.75	0.01	2.52	3.72	4.11	2.46	1.85	0.22	4.53	4.50	4.31	4.00	**15127**
....	0.56	0.66	0.87	1.52	3.61	3.29	5.41	4.45	3.02	12.88	11.00	9.86	10.00	**14776**
....	none	0.43	0.76	0.71	1.90	1.65	5.65	4.17	1.23	11.05	11.00	9.82	10.00	**14573**
49.00	none	0.23	0.77	1.64	2.64	2.47	7.58	2.30	1.60	11.48	11.00	9.88	10.00	**14923**
1.00	0.81	0.08	none	3.60	4.49	4.11	1.51	4.09	0.32	5.92	5.00	5.60	4.00	**14718**
....	0.56	1.13	0.63	1.76	4.08	4.11	7.19	2.84	1.59	11.62	11.00	10.03	10.00	**14581**
36.40	0.79	0.94	0.65	1.65	4.03	4.11	7.40	2.69	1.50	11.59	11.00	10.09	10.00	**14635**

TABLE VII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.
	Sampled by Station:	
	M. S. Shoemaker & Co., Philadelphia, Pa.	
14583	Swift-Sure Superphosphate for Tobacco	Windsor Locks
14877	Swift-Sure Superphosphate for Tobacco	Meriden
	Virginia-Carolina Chemical Co., New York City.	
15073	Monarch Brand	North Haven
15140	Pawnee Brand	Granby
	Wilcox Fertilizer Co., Mystic, Conn.	
14722	Grain Fertilizer	Mystic
	Sampled by Purchasers:	
15052	National Fertilizer Co.'s Tobacco Manure 5–4–0	Thompsonville: Henry Davis
14373	Rogers and Hubbard's Climax Tobacco Brand	Windsor: F. H. Thrall.
	Manufacturer's Sample:	
14308	L. T. Frisbie's 2–8	New Haven

NITROGENOUS SUPERPHOSPHATES CONTAINING POTASH.

In the following table are given 246 analyses of brands belonging to this class, 226 of which were sampled by the Station Agent.

The number of brands containing potash is twice as great as it was the year before.

Only seven brands contained six per cent. or more but 138 contained between three and five per cent. of potash.

COMPOSITION AND COST OF THE BRANDS.

The cost of nitrogen per pound has been calculated in all the brands having the composition given below, allowing 10 cents per pound for available phosphoric acid and 16 cents per pound for potash.

Formula.	No. of Analyses.	Average cost.	Nitrogen costs per pound.
.82-8-2	7	$50.66	$1.91
1.65-8-2	25	53.06	.93
2.47-8-4	15	62.87	.68
3.29-8-4	21	65.79	.56
4.11-4-3	12	82.96	.80

WITHOUT POTASH—(*Concluded*).

	Nitrogen.						Phosphoric Acid.							
					Total.					Total.		So-called "Available".		
per ton.	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
.00	none	0.99	0.71	1.85	3.55	3.29	3.85	5.18	3.84	12.87	12.00	9.03	10.00	**14583**
.00	0.12	1.38	0.52	1.60	3.62	3.29	5.89	4.88	3.34	14.11	12.00	10.77	10.00	**14877**
.00	0.13	0.16	0.47	0.95	1.71	1.65	8.76	2.63	1.24	12.63	12.00	11.39	11.00	**15073**
.25	0.28	0.58	1.55	1.63	4.04	4.11	3.31	1.07	0.69	5.07	5.00	4.38	4.00	**15140**
..	0.18	0.30	0.19	1.15	1.82	1.64	6.33	3.27	2.60	12.26	11.00	9.60	10.00	**14722**
..	..	..	...	...	4.42	...	...	...	...	5.94	...	...	...	**15052**
..	..	..	...	...	4.02	4.11	...	...	...	5.87	5.00	...	...	**14373**
..	none	..	...	...	1.65	...	...	...	...	9.11	...	...	...	**14308**

Here again it appears that nitrogen in low grade mixtures costs more than twice as much as in the higher grades in spite of their somewhat lower price and that their purchase is wasteful.

GUARANTIES

Ninety-five out of the 226 analyses do not fully meet their guaranty in every particular. In most cases the deficiency is in one ingredient only, and is more than made good by an overrun in the other two.

In 26 cases there is a deficiency in two or three ingredients, and in the following brands this results in a deficiency in money value.

That is, the value of the amount of plant food guaranteed in a ton of goods, but not supplied, is the sum given in the following statement. For this calculation nitrogen is valued at 50 cents, available phosphoric acid 10 cents, and potash at 16 cents per pound, respectively, which is about their retail selling price. See page 56.

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	American Agricultural Chemical Co., New York City.		
14611	Double A Tobacco Fertilizer	Suffield	$85
15116	Fish and Potash	Windsor	..
14786	Grass and Lawn Top Dressing	New London	93
14947	Grass and Oats Fertilizer	Southington	..
14953	Monarch Potato Manure	Southport	68
14692	Sure Growth Phosphate Revised	Thompsonville	62
14684	Universal Phosphate	New London	55
15120	Bradley's Alkaline Bone with Potash	Rockville	42
14951	Bradley's B. D. Guano	North Haven	47
14686	Bradley's Corn Phosphate	Norwich	52
15118	Bradley's Half Century Fertilizer Revised	Granby	..
14793	Bradley's New Method Fertilizer	Norwalk	50
14518	Bradley's Patent Superphosphate Revised	Hamden	51
14687	Bradley's Potato Fertilizer	Norwich	55
14517	Bradley's Potato Manure	Hamden	62
14693	Bradley's Unicorn	Thompsonville	54
14980	Bradley's Valley Tobacco Fertilizer	New Milford	60
15139	Bradley's XL Superphosphate of Lime	Mansfield	59
15122	East India Black Hawk Potato and Truck Fertz	Gaylordsville	63
14950	East India Economizer Phosphate	North Haven	58
15034	East India Mayflower	Watertown	..
15121	East India Tobacco Fertilizer	Gaylordsville	81
14954	Great Eastern General	Waterford	52
15031	Great Eastern North Corn Special 1920	Warehouse Point	50
14981	Great Eastern Potato Manure, 1920	New Milford	53
15046	Packer's Union Animal Corn Fertilizer	Litchfield	58
14965	Packer's Union Potato Manure 1920	Southington	..
14791	Quinnipiac Ammoniated Dissolved Phosphate	Milford	47
14524	Quinnipiac Climax Phosphate	Southport	45
14657	Quinnipiac Corn Manure	New London	60
14790	Quinnipiac Phosphate	Milford	50
14545	Quinnipiac Potato Manure	Southport	61
14598	Quinnipiac Wrapper Leaf Brand Tobacco Manure Revised	Windsor	79
15032	Wheeler's Cuban Tobacco Grower	Warehouse Point	86
14787	Williams and Clark's Americus H. G. Special Revised	Waterbury	72
14788	Williams and Clark's Americus Potato Manure	Waterbury	57
14869	Williams and Clark's Matchless Fertilizer	South Manchester	49
15048	Williams and Clark's Prolific Fertilizer	New Britain	58
14910	Williams and Clark's Seed Leaf Tobacco Manure Revised	South Manchester	82
	Apothecaries Hall Co., Waterbury, Conn.		
15040	Liberty Market Gardeners' Special	Waterbury	64
14649	Liberty Tobacco Special	Windsorville	82

WITH POTASH.

Nitrogen.					Phosphoric Acid.							Potash.		
			Total.					Total.		So-called "Available."				
In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.
0.07	1.53	1.74	4.48	4.11	0.92	4.35	0.19	5.46	5.00	5.27	4.00	1.50	4.78	5.00
0.08	0.43	1.43	2.61	2.47	5.87	4.57	2.48	12.92	11.00	10.44	10.00	2.01	2.01	3.00
1.16	1.08	0.73	5.00	4.94	4.62	2.80	1.16	8.58	7.00	7.42	6.00	3.82	3.82	4.00
..	..	..	0.65	..	6.65	5.32	0.86	12.83	13.00	11.97	12.00	0.82	2.44	2.00
1.75	0.06	1.56	3.50	3.29	5.41	3.02	1.04	9.47	9.00	8.43	8.00	4.23	4.23	4.00
0.52	0.39	0.94	2.55	2.47	4.23	4.97	1.71	10.91	10.00	9.20	9.00	0.45	1.92	2.00
0.31	0.02	0.43	1.01	0.82	3.82	4.23	0.93	8.98	9.00	8.05	8.00	1.54	1.79	2.00
..	..	..	..	..	6.37	5.21	0.83	12.41	13.00	11.58	12.00	2.04	2.04	2.00
0.24	0.34	0.53	1.22	0.82	5.01	2.73	0.58	8.32	9.00	7.74	8.00	4.81	4.81	4.00
0.50	0.50	0.84	1.84	1.65	3.87	4.19	1.56	9.62	9.00	8.06	8.00	1.18	1.91	2.00
0.16	0.10	0.99	1.50	1.65	5.44	3.95	1.23	10.62	9.00	9.39	8.00	3.55	3.55	3.00
0.13	0.32	0.57	1.09	0.82	4.75	4.02	0.63	9.40	9.00	8.77	8.00	1.82	2.36	2.00
0.46	0.54	0.84	2.06	1.65	4.64	4.39	1.27	10.30	10.00	9.03	9.00	1.30	1.30	1.00
0.18	0.47	0.62	1.77	1.65	5.04	3.04	1.60	9.68	9.00	8.08	8.00	2.69	2.69	3.00
0.13	0.76	1.13	2.42	2.47	3.90	5.20	1.38	10.48	9.00	9.10	8.00	3.06	4.40	4.00
0.72	0.38	0.61	1.85	1.65	4.79	3.54	1.55	9.88	9.00	8.33	8.00	2.06	2.06	2.00
none	0.37	3.04	4.38	4.11	1.91	3.88	0.37	6.16	5.00	5.79	4.00	0.48	2.97	3.00
0.83	0.22	0.69	2.65	2.47	3.99	5.33	0.74	10.06	10.00	9.32	9.00	2.33	2.33	2.00
0.06	0.77	0.96	2.52	3.29	6.74	3.39	0.49	10.62	9.00	10.13	8.00	5.11	5.11	4.00
0.43	0.35	0.84	1.81	0.82	3.94	4.33	1.24	9.51	9.00	8.27	8.00	2.71	2.71	2.00
0.59	0.21	0.98	1.89	1.65	6.18	3.30	2.05	11.53	9.00	9.48	8.00	2.24	2.24	2.00
0.10	0.56	2.61	4.12	4.11	1.22	4.44	0.33	5.99	5.00	5.66	4.00	0.43	2.87	3.00
0.05	0.08	0.32	0.76	0.82	5.46	2.84	0.22	8.52	9.00	8.30	8.00	5.56	5.56	4.00
0.09	0.19	1.70	2.42	1.65	4.65	4.42	1.41	10.48	9.00	9.07	8.00	2.04	2.04	2.00
0.60	0.25	0.72	1.66	1.65	5.64	2.71	0.78	9.13	9.00	8.35	8.00	3.27	3.27	3.00
0.84	0.26	0.74	2.43	2.47	6.14	3.07	0.91	10.12	10.00	9.21	9.00	2.31	2.31	2.00
0.31	0.37	0.94	1.79	1.65	5.68	4.58	1.01	11:27	11.00	10.26	10.00	3.99	4.35	4.00
0.44	0.10	1.09	1.87	1.65	3.84	4.77	0.82	9.43	9.00	8.61	8.00	1.50	2.19	2.00
0.70	0.41	0.86	2.11	0.82	5.55	2.44	1.39	9.38	9.00	7.99	8.00	2.22	2.22	2.00
0.49	0.22	0.53	2.00	1.65	4.72	4.05	0.33	9.10	9.00	8.77	8.00	2.67	2.67	2.00
0.80	0.15	1.39	2.64	2.47	4.35	5.08	1.28	10.71	10.00	9.43	9.00	0.90	2.02	2.00
0.18	0.73	1.26	2.57	2.47	4.11	4.70	1.73	10.54	9.00	8.81	8.00	2.90	3.79	4.00
0.04	0.52	2.73	4.37	4.11	0.94	5.47	0.37	6.78	5.00	6.41	4.00	0.65	3.03	3.00
0.05	0.91	2.56	4.31	4.11	1.15	4.19	0.54	5.88	5.00	5.34	4.00	0.58	5.10	5.00
1.01	0.54	0.68	3.43	3.29	5.54	3.00	1.02	9.56	9.00	8.54	8.00	3.87	3.87	4.00
0.55	0.29	0.97	1.95	1.65	2.36	6.31	1.30	9.97	9.00	8.67	8.00	1.82	2.96	3.00
0.60	0.68	1.53	3.24	1.65	5.02	3.99	1.83	10.84	9.00	9.01	8.00	2.00	2.00	2.00
0.22	0.27	0.69	1.44	0.82	4.36	3.70	1.05	9.11	8.00	8.06	7.00	0.68	1.80	1.00
0.96	0.82	2.34	4.27	4.11	0.36	5.40	0.12	5.88	5.00	5.76	4.00	1.22	3.29	3.00
0.95	0.67	1.67	3.53	3.29	5.30	2.93	0.97	9.20	9.00	8.23	8.00	3.58	3.58	4.00
0.75	0.31	3.07	4.29	4.11	2.85	1.72	0.43	5.00	5.00	4.57	4.00	0.31	2.41	3.00

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton
	Sampled by Station:		
	Armour Fertilizer Works, Chrome, N. J.		
14750	Cereal Special No. 1	New Haven	$67
14944	Complete Potato Fertilizer	Rockville	85
14907	Gardeners' Choice Fertilizer	Thompsonville	62
14710	General Crop Fertilizer	New Haven	44
14694	Grain Grower Fertilizer	New Haven	56
14683	Potato, Onion and Vegetable Fertilizer	New London	63
14912	Super-Grade Potato Mixture Fertilizer	Rockville	75
15160	Tobacco Special Fertilizer	South Manchester	85
14748	*Wheat and Clover Fertilizer	New Haven	55
15033	Bidwell's Formula	Windsor Locks	64
	Atlantic Packing Co., New Haven, Conn.		
14860	3-8-3	New Britain	65
14690	*Grain Fertilizer	Willimantic	60
14685	Potato Phosphate 3-8-4	Norwich	53
14861	Special Vegetable	New Britain	75
15050	*Tobacco Grower	Hockanum	84
14691	Tobacco Special	East Hartford	71
	Berkshire Fertilizer Co., Bridgeport, Conn.		
14789	Ammoniated Bone Phosphate	Waterbury	54
14647	Complete Fertilizer	Ellington	56
14650	Complete Tobacco	Hazardville	82
14743	Market Garden Fertilizer	Ellington	65
14591	Potato and Vegetable Phosphate	Ellington	47
	Bowker Fertilizer Co., New York City.		
14594	All Round Fertilizer	Hazardville	61
14641	Connecticut Valley Tobacco Fertilizer	Thompsonville	80
14655	Corn, Grain and Grass Phosphate	New London	60
14593	Fisherman's Brand Fish and Potash	Hazardville	60
14615	Hill and Drill Phosphate	Hazardville	56
14843	Lawn and Garden Dressing Revised	New Haven	66
14703	Potato and Vegetable Phosphate	Norwich	62
14638	Square Brand Farm and Garden Phosphate	Milldale	53
14656	Sure Crop Phosphate Revised	New London	55
15080	Stockbridge Complete	Uncasville	80
14619	Stockbridge Market Garden Manure	Milldale	70
15126	Stockbridge Tobacco Manure	Granby	88
	E. D. Chittenden Co., Bridgeport, Conn.		
15110	†Complete Tobacco and Onion Grower	Suffield	63
14905	Tobacco Special with 5% Potash	Suffield	83

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*See note, page 56. †See note, page 57.

WITH POTASH—(*Continued*).

Nitrogen.					Phosphoric Acid.							Potash.			
			Total.					Total.		So-called "Available."					
In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
0.44	0.42	0.64	1.50	1.65	8.23	1.95	0.90	11.08	10.50	10.18	10.00	6.55	6.55	6.00	**14750**
0.23	0.04	0.73	1.71	1.65	6.76	1.72	0.59	9.07	8.50	8.48	8.00	3.90	3.90	4.00	**14944**
0.80	0.45	0.91	2.42	2.47	6.16	2.37	0.96	9.49	8.50	8.53	8.00	3.84	3.84	4.00	**14907**
0.57	none	0.26	0.93	0.82	5.77	1.60	0.27	7.64	7.50	7.37	7.00	1.05	1.05	1.00	**14710**
1.04	0.08	0.43	1.71	1.65	5.64	2.19	0.73	8.56	8.50	7.83	8.00	1.88	1.88	2.00	**14694**
1.86	0.42	0.59	3.31	3.29	6.22	2.11	0.52	8.85	8.50	8.33	8.00	3.71	3.71	4.00	**14683**
2.45	0.60	1.07	4.12	4.11	6.54	1.95	0.90	9.39	8.50	8.49	8.00	4.83	4.83	5.00	**14912**
none	0.22	3.01	4.08	4.11	2.78	2.24	0.23	5.25	4.50	5.02	4.00	0.31	3.11	3.00	**15160**
..	..	..	0.22	..	7.91	1.18	0.36	9.45	10.50	9.09	10.00	3.88	3.88	5.00	**14748**
1.24	0.09	1.11	2.62	2.47	6.94	1.30	0.29	8.53	8.50	8.24	8.00	0.20	4.87	5.00	**15033**
0.95	0.57	0.91	2.49	2.40	4.43	3.77	0.63	8.83	9.00	8.20	8.00	3.12	3.12	3.00	**14860**
0.41	0.32	0.56	1.44	1.64	4.34	2.79	0.47	7.60	9.00	7.13	8.00	2.06	2.06	2.00	**14690**
0.70	0.58	0.82	2.47	2.46	5.00	3.44	0.59	9.03	9.00	8.44	8.00	4.02	4.02	4.00	**14685**
1.80	0.19	1.03	3.18	3.28	4.46	3.91	0.92	9.29	9.00	8.37	8.00	3.91	3.91	4.00	**14861**
0.03	0.81	1.45	3.84	4.10	0.67	3.30	2.43	6.40	6.00	3.97	5.00	0.96	4.48	4.00	**15050**
0.07	0.75	1.94	4.14	4.10	1.70	3.18	2.23	7.11	6.00	4.88	5.00	0.78	1.97	2.00	**14691**
0.70	none	0.30	1.09	0.80	6.61	3.83	0.40	10.84	11.00	10.44	10.00	2.10	2.10	2.00	**14789**
1.00	0.17	1.42	2.81	2.50	4.35	3.66	1.41	9.42	9.00	8.01	8.00	3.22	3.22	3.00	**14647**
0.16	0.81	2.26	4.26	4.11	0.76	4.02	0.41	5.19	4.00	4.78	4.00	1.59	4.06	4.00	**14650**
0.92	0.14	1.77	3.30	3.30	1.72	5.86	1.54	9.12	9.00	7.58	8.00	3.93	3.93	4.00	**14743**
0.57	0.12	1.04	1.84	1.70	6.79	3.85	1.16	11.80	9.00	10.64	8.00	2.29	2.29	2.00	**14591**
0.24	0.62	1.28	2.59	2.47	3.54	5.12	1.41	10.07	9.00	8.66	8.00	4.19	4.19	4.00	**14594**
0.09	0.55	2.71	4.52	4.11	0.94	4.37	0.23	5.54	5.00	5.31	4.00	0.76	3.00	3.00	**14641**
0.41	0.23	0.56	1.91	1.65	4.97	3.66	0.82	9.45	9.00	8.63	8.00	2.06	2.29	2.00	**14655**
0.59	0.09	0.98	2.51	2.47	5.35	4.90	1.07	11.32	11.00	10.25	10.00	3.02	3.02	3.00	**14593**
0.76	0.68	0.77	2.64	2.47	2.45	6.61	1.37	10.43	10.00	9.06	9.00	0.57	1.93	2.00	**14615**
0.80	0.18	1.34	2.64	2.47	4.25	5.16	1.32	10.73	10.00	9.41	9.00	0.88	2.07	2.00	**14843**
0.12	0.19	0.95	1.82	1.65	3.38	5.15	1.65	10.18	9.00	8.53	8.00	3.37	3.37	3.00	**14703**
0.14	0.23	0.98	1.91	1.65	3.31	4.96	0.95	9.22	9.00	8.27	8.00	1.21	2.12	2.00	**14638**
0.30	none	0.38	0.93	0.82	3.61	3.97	0.90	8.48	9.00	7.58	8.00	1.71	1.99	2.00	**14656**
1.34	0.12	1.34	4.09	4.11	4.40	3.94	0.50	8.84	9.00	8.34	8.00	4.26	4.26	4.00	**15080**
0.96	0.36	0.72	3.30	3.29	4.16	4.04	1.13	9.33	9.00	8.20	8.00	3.95	3.95	4.00	**14619**
0.79	0.55	2.84	4.48	4.11	0.82	4.80	0.55	6.17	5.00	5.62	4.00	0.58	4.57	5.00	**15126**
none	0.16	0.57	3.29	3.29	4.15	3.84	0.61	8.60	9.00	7.99	8.00	4.06	4.06	4.00	**15110**
0.05	0.24	1.67	4.30	4.11	3.29	2.73	0.40	6.42	5.00	6.02	4.00	0.51	4.76	5.00	**14905**

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton
	Sampled by Station:		
	Everett B. Clark Seed Co., Milford, Conn.		
14802	Special Mixture with Potash	Orange	$53.0
	The Coe-Mortimer Co., New York City.		
14745	Celebrated Special Potato Fertz. Revised	Poquonock	66.0
14599	Columbian Corn and Potato Fertilizer	Poquonock	51.5
14915	Corn King	Abington	55.0
14639	Connecticut Wrapper Grower	Poquonock	82.0
15081	Dissolved Phosphate and Potash	Gilead	32.0
14654	Gold Brand Excelsior Guano Revised	Wethersfield	63.0
14700	New Englander Special	Poquonock	48.0
15026	Special Grass Top Dressing	Plantsville	78.0
14972	Tobacco Leaf Fertilizer	Glastonbury	81.0
	Columbia Guano Co., Baltimore, Md.		
15030	*†Freedom Guano	Melrose	...
15029	Soluble Guano	Melrose	...
	Essex Fertilizer Co., Boston, Mass.		
14704	Fish Fertilizer 3-8-3	South Manchester	70.0
14705	Market Garden 3-8-4	South Manchester	71.0
15027	*Tobacco 5-5-4	Hartford	.
14746	1-10-1	South Manchester	50.0
14874	*2-8-2	South Manchester	58.0
15028	*4-8-4	Broad Brook	61.2
15005	5-7-2	Weatogue	83.0
	L. T. Frisbie Co., New Haven, Conn.		
15109	Complete Manure	Simsbury	70.0
14582	*Corn and Grain Fertz. 2-8-2	New Britain	55.0
14539	Special	Guilford	60.0
14595	Special Vegetable and Potato Grower 4-8-4	North Haven	69.0
14882	Special Vegetable and Potato Grower 4-8-4	Milford	58.7
14948	Tobacco Grower	Silver Lane	78.5
14911	*Tobacco Special	Rockville	80.0
14658	*Tobacco 5-5-5	East Hartford	78.0
14620	3-8-3	Plantsville	68.0
	Hubbard Fertilizer Co., Baltimore, Md.		
15043	*‡Noxall Guano	Ellington	59.4
	International Agricultural Corporation, Buffalo, N. Y.		
14773	Buffalo Economy	Ansonia	51.6
15014	Buffalo Farmers' Choice	Ellington	.
15007	Buffalo General Favorite	East Granby	.

*See note, page 56. †See note, page 57. ‡See note, page 59.

WITH POTASH—(*Continued*)

Nitrogen.						Phosphoric Acid.							Potash.		
[illegible]	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		As muriate.	Total.	Guaranteed.
				Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
14	2.54	0.13	0.85	3.66	3.29	8.08	2.05	0.72	10.85	...	10.13	10.00	3.31	3.31	3.00
71	0.75	0.63	1.23	3.32	3.29	3.88	5.07	1.22	10.17	9.00	8.95	8.00	3.87	4.10	4.00
36	0.12	0.18	0.82	1.48	1.65	3.74	5.02	1.36	10.12	9.00	8.76	8.00	2.91	2.91	3.00
53	0.65	0.41	1.01	2.60	2.47	5.51	3.48	1.83	10.82	10.00	8.99	9.00	2.33	2.33	2.00
99	0.08	0.53	2.54	4.14	4.11	0.82	4.49	0.31	5.62	5.00	5.31	4.00	1.50	4.94	5.00
..	..	..	..	..	..	7.69	4.50	0.32	12.51	13.00	12.19	12.00	2.11	2.11	2.00
64	0.59	0.38	1.03	2.64	2.47	2.84	5.65	1.27	9.76	9.00	8.49	8.00	0.84	3.83	4.00
14	0.08	0.02	0.76	1.00	0.82	4.33	4.66	0.87	9.86	9.00	8.99	8.00	2.08	2.08	2.00
79	2.04	0.32	1.13	5.28	4.94	3.40	3.18	0.37	6.95	7.00	6.58	6.00	3.88	3.88	4.00
07	none	0.60	2.61	4.28	4.11	0.62	4.86	0.14	5.62	5.00	5.48	4.00	0.80	3.09	3.00
31	1.53	0.25	1.07	3.16	3.30	5.00	2.68	1.52	9.20	8.50	7.68	8.00	3.74	3.74	4.00
09	0.85	0.15	0.60	1.69	1.65	5.05	2.62	1.39	9.06	8.50	7.67	8.00	1.83	1.83	2.00
78	0.45	0.53	0.78	2.54	2.47	5.42	3.13	1.25	9.80	9.00	8.55	8.00	2.96	2.96	3.00
96	0.12	0.56	0.67	2.31	2.46	6.39	1.79	0.61	8.79	9.00	8.18	8.00	3.99	3.99	4.00
30	0.06	0.85	1.81	4.02	4.10	1.62	3.40	2.14	7.16	6.00	5.02	5.00	0.82	3.83	4.00
none	0.09	0.53	0.40	1.02	0.82	7.47	2.89	1.27	11.63	11.00	10.36	10.00	1.20	1.20	1.00
25	0.12	0.60	0.67	1.64	1.64	3.75	3.93	1.15	8.83	9.00	7.68	8.00	1.55	1.84	2.00
07	1.49	0.66	0.82	3.04	3.29	4.78	3.48	0.45	8.71	9.00	8.26	8.00	3.88	3.88	4.00
45	0.05	0.90	1.60	4.00	4.10	3.03	3.83	2.16	9.02	8.00	6.86	7.00	0.84	2.04	2.00
46	0.92	0.65	1.10	3.13	3.29	3.55	4.17	0.95	8.67	9.00	7.72	8.00	6.42	6.42	6.00
05	0.38	0.46	0.54	1.43	1.65	2.93	3.98	0.46	7.37	9.00	6.91	8.00	2.10	2.10	2.00
49	0.46	0.64	0.78	2.37	2.46	4.95	3.34	0.58	8.87	9.00	8.29	8.00	4.00	4.00	4.00
82	1.10	0.76	0.89	3.37	3.28	3.94	3.42	1.25	8.61	9.00	7.36	8.00	4.35	4.35	4.00
11	1.73	0.69	0.99	3.52	3.28	4.28	3.92	1.01	9.21	9.00	8.20	8.00	3.80	3.80	4.00
18	0.06	1.16	1.67	4.07	4.10	1.17	3.72	2.53	7.42	6.00	4.89	5.00	1.04	3.98	4.00
27	0.09	0.83	1.64	3.83	4.10	1.35	3.53	2.46	7.34	6.00	4.88	5.00	0.92	1.79	2.00
07	0.05	0.71	1.97	3.80	4.10	1.78	2.77	1.87	6.42	6.00	4.55	5.00	0.73	5.47	5.00
none	0.98	0.71	0.78	2.47	2.46	4.52	3.76	1.30	9.58	9.00	8.28	8.00	3.14	3.14	3.00
00	none	0.40	0.67	3.07	3.28	5.34	3.21	0.24	8.79	9.00	8.55	8.00	1.14	3.81	4.00
40	0.08	0.52	0.63	1.63	1.60	5.45	2.72	1.36	9.53	9.00	8.17	8.00	2.20	2.20	2.00
27	0.08	0.52	0.39	1.26	0.80	5.92	4.62	1.34	11.88	11.00	10.54	10.00	2.35	2.35	2.00
one	0.21	0.45	0.52	1.18	0.80	5.20	4.63	0.99	10.82	9.00	9.83	8.00	0.70	1.29	1.00

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton
	Sampled by Station:		
	International Agricultural Corporation, Buffalo, N. Y. (*Continued*)		
15079	Buffalo High Grade Manure	East Haven	$65.50
15006	Buffalo New England Special	Tariffville	57.50
14711	Buffalo Onion, Vegetable and Potato	Shelton	60.00
15008	Buffalo Tobacco Producer	East Granby	....
	A. L. Koster, Suffield, Conn.		
14974	Hale Tobacco Mixture	Windsor Locks	....
	Lister's Agricultural Chemical Works, Newark, N. J.		
14864	Celebrated Tobacco Fertilizer	Burnside	81.00
14865	*Complete Tobacco Manure	Burnside	86.00
14970	Corn and Potato Fertilizer	Glastonbury	61.00
15011	Eastern Pride Fertilizer	Rockville	....
15111	King Bee Fertilizer	Yalesville	....
15112	Special Crop Producer	Yalesville	....
14979	Special Tobacco Fertilizer	Brookfield	60.00
14824	Standard Pure Superphosphate of Lime	Burnside	54.75
15047	Success Fertilizer	East Canaan	53.00
	Lowell Fertilizer Co., Boston, Mass.		
14520	Animal Brand 3-8-4	Southington	70.00
14543	Bone Fertilizer 2-8-2	Southington	58.00
14522	Empress Brand 1-10-1	New Britain	54.00
15049	*Lawn and Garden Dressing	Hartford	....
14706	Tobacco 5-5-4	Warehouse Point	84.00
14819	Tobacco 5-7-2	Granby	82.00
14702	2-8-3	Saybrook	60.00
14975	4-8-4	Westport	65.75
14817	*5-8-4	Wethersfield	72.00
	Mapes' Formula and Peruvian Guano Co., New York City.		
14548	Corn Manure	Windsor Locks	56.00
14614	C. S. Tobacco Manure	Rockville	62.00
14701	General Tobacco Manure	Hartford	85.00
14742	†General Truck Manure	Windsor Locks	72.00
15013	*Grain Brand	Rockville	50.00
14527	Potato Manure	Windsor Locks	71.00
14653	†Potato Manure, 1916 Brand	Glastonbury	....
14584	Tobacco Starter Improved	Windsor Locks	61.00

* See note, page 56. †See note, page 59.

WITH POTASH—(*Continued*).

Nitrogen.					Phosphoric Acid.							Potash.			
			Total.					Total.		So-called "Available."					
In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station N
0.09	1.03	1.12	3.13	3.30	3.76	4.77	1.64	10.17	9.00	8.53	8.00	3.61	4.30	4.00	150
0.15	1.05	0.72	1.92	1.60	5.42	4.86	1.45	11.73	11.00	10.28	10.00	3.59	3.82	4.00	150
0.07	0.61	0.77	2.42	2.50	5.86	2.68	1.46	10.00	9.00	8.54	8.00	3.07	3.07	3.00	147
0.06	0.75	1.24	4.26	4.10	0.89	3.61	1.45	5.95	5.00	4.50	4.00	0.94	2.11	2.00	150
0.94	0.36	2.80	5.10	4.94	1.06	5.76	1.15	7.97	...	6.82	5.00	2.18	4.81	4.00	149
0.09	none	3.24	4.06	4.11	2.28	3.57	0.33	6.18	5.00	5.85	4.00	1.04	2.85	3.00	148
0.19	0.49	0.61	4.12	4.11	1.84	2.42	1.15	5.41	5.00	4.26	4.00	4.33	4.33	5.00	148
0.13	0.76	0.68	1.70	1.65	3.62	4.06	2.06	9.74	9.00	7.68	8.00	2.79	2.79	3.00	149
0.22	0.76	0.59	2.47	2.47	6.41	2.02	1.43	9.86	9.00	8.43	8.00	3.76	3.76	4.00	150
0.66	0.51	0.53	1.80	1.65	5.21	3.36	1.74	10.31	11.00	8.57	10.00	5.63	5.63	4.00	151
0.11	0.26	0.44	0.92	0.82	4.61	2.82	0.73	8.16	8.00	7.43	7.00	0.51	2.16	1.00	151
0.22	0.85	0.72	1.87	1.65	7.10	2.93	2.12	12.15	11.00	10.03	10.00	3.66	3.66	4.00	149
0.24	0.56	0.58	2.52	2.47	4.57	4.43	1.52	10.52	10.00	9.00	9.00	0.62	1.90	2.00	148
0.20	0.24	0.49	1.85	1.65	7.78	1.48	0.50	9.76	9.00	9.26	8.00	1.86	1.86	2.00	150
0.92	1.22	0.71	2.92	2.46	6.12	2.44	0.83	9.39	9.00	8.56	8.00	3.58	3.58	4.00	145
0.16	0.57	0.85	1.78	1.64	3.89	3.95	1.37	9.21	9.00	7.84	8.00	1.74	2.03	2.00	145
0.28	0.39	0.54	1.37	0.82	6.89	3.21	0.90	11.00	11.00	10.10	10.00	1.96	1.96	1.00	145
2.93	0.14		3.14	3.28	5.62	1.50	1.73	8.85	8.00	7.12	7.00	1.88	1.88	2.00	150
0.09	1.12	1.72	4.15	4.10	1.49	3.08	2.15	6.72	6.00	4.57	5.00	0.90	4.22	4.00	147
0.09	1.06	1.85	4.19	4.10	2.63	4.14	1.87	8.64	8.00	6.77	7.00	0.70	1.98	2.00	148
0.13	0.39	0.65	1.73	1.64	5.63	2.97	1.05	9.65	9.00	8.60	8.00	3.15	3.15	3.00	147
1.67	0.61	0.79	3.25	3.28	3.79	4.29	0.96	9.04	9.00	8.08	8.00	3.98	3.98	4.00	149
1.01	0.68	0.91	3.61	4.10	5.23	3.11	1.20	9.54	9.00	8.34	8.00	3.78	3.78	4.00	148
none	0.18	0.90	2.57	2.47	3.58	3.74	2.94	10.26	10.00	7.32	8.00	3.33	3.33	3.00	145
0.09	0.65	2.07	4.25	4.12	0.49	4.38	1.25	6.12	4.00	4.87	4.00	0.70	1.45	1.00	146
0.09	1.00	2.11	4.39	4.12	0.41	4.59	0.28	5.28	4.00	5.00	4.00	1.30	5.41	5.00	147
0.10	0.04	1.40	4.50	4.12	2.05	4.20	1.92	8.17	8.00	6.25	6.00	5.13	5.13	5.00	147
0.16	0.15	0.57	1.72	1.65	1.65	4.85	3.99	10.49	10.00	6.50	8.00	1.99	1.99	2.00	150
none	0.11	0.45	3.68	3.71	3.75	3.29	1.61	8.65	8.00	7.04	7.00	4.91	4.91	5.00	145
0.05	0.03	0.28	3.71	3.71	4.25	2.75	0.96	7.96	8.00	7.00	8.00	0.65	1.53	1.00	146
0.07	0.86	1.77	4.55	4.12	1.82	4.27	3.67	9.76	8.00	6.09	6.00	0.54	1.50	1.00	145

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton
	Sampled by Station:		
	National Fertilizer Co., New York City.		
14818	Complete Tobacco Fertilizer	Simsbury	$80
14575	Eureka Potato Fertilizer	West Cheshire	64.
14589	Market Garden Fertilizer Revised	South Manchester	62.
14596	Potato Phosphate	Meriden	53
14708	Soluble Bone and Potash	Somersville	37.
14921	Special Tobacco, Revised	Hartford	85.
14612	Universal Phosphate	South Manchester	45
14541	XXX Fish and Potash	West Cheshire	58
	New England Fertilizer Co., Boston, Mass.		
14648	*Corn Phosphate 2-8-2	Rockville	55
14592	Standard Phosphate 1-10-1	Rockville	48
14816	Superphosphate 3-8-4	Hamden	67
14832	Tobacco 5-5-4	Warehouse Point	85.
14526	2-8-3	Meriden	55.
14876	2-8-3	East Wallingford	53
14547	3-8-3	Meriden	60
	Olds & Whipple, Hartford, Conn.		
14841	Complete Corn, Potato and Onion Fertilizer	Simsbury	
14766	Complete Tobacco Fertilizer	Hazardville	
14991	Complete Tobacco Fertilizer	Scitico	
15155	Complete Tobacco Fertilizer	East Windsor Hill	76
14842	Special Corn, Onion and Potato Fertilizer	Simsbury	
	Parmenter & Polsey, Boston, Mass.		
14767	Plymouth Rock 3-8-4	Plantsville	63.
15151	Tobacco 5-5-4	Bloomfield	78
15107	1-10-1	Plantsville	45
14964	*2-8-2	West Hartford	50
	Pawtucket Rendering Co., Pawtucket, R. I.		
14959	2-8-2	Brooklyn	
	Piedmont-Mt. Airy Guano Co., Baltimore, Md.		
14856	*Brown's H. G. Potato and Gen. Crop Manure	South Meriden	60
14871	Brown's Potato Fertilizer	South Meriden	54
14857	Brown's Special O. & T. Dresser and Market Garden	Meriden	66
14963	*Shay's Corn Fertilizer	Chester	64
14962	*Shay's Potato Fertilizer	Groton	
14961	Shay's Special Fertilizer	Groton	
	Quality Fertilizer Works, Stamford, Conn.		
15208	Bartlett Brand Special Tree Fertilizer	Stamford	[illegible]

*See note, page 56.

WITH POTASH—(*Continued*).

Nitrogen.					Phosphoric Acid.							Potash.			
			Total.					Total.		So-called "Available."					
In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
0.73	0.66	2.65	4.24	4.11	0.90	4.84	0.36	6.10	5.00	5.74	4.00	0.82	4.41	5.00	**14818**
1.13	0.64	0.94	3.51	3.29	0.13	7.84	1.68	9.65	9.00	7.97	8.00	0.74	4.08	4.00	**14575**
0.16	0.60	1.19	2.44	2.47	3.92	5.14	1.33	10.39	9.00	9.06	8.00	3.39	4.24	4.00	**14589**
0.17	0.22	0.98	1.85	1.65	3.87	4.72	1.39	9.98	9.00	8.59	8.00	3.29	3.29	3.00	**14596**
. .	. .	. .	. .	..	7.10	4.68	0.90	12.68	13.00	11.78	12.00	2.05	2.05	2.00	**14708**
0.05	0.65	2.62	4.33	4.11	0.54	4.85	0.14	5.53	5.00	5.39	4.00	0.90	3.17	3.00	**14921**
0.11	0.25	0.59	1.03	0.82	5.15	3.13	0.99	9.27	9.00	8.28	8.00	2.02	2.02	2.00	**14612**
0.87	0.25	0.73	2.64	2.47	4.74	5.31	1.20	11.25	11.00	10.05	10.00	0.93	2.88	3.00	**14541**
0.17	0.62	0.73	1.65	1.64	3.55	3.75	1.41	8.71	9.00	7.30	8.00	1.49	1.84	2.00	**14648**
0.10	0.35	0.48	1.04	0.82	7.48	3.35	1.05	11.88	11.00	10.83	10.00	1.12	1.12	1.00	**14592**
1.01	0.69	0.73	2.54	2.46	5.64	2.48	0.68	8.80	9.00	8.12	8.00	3.57	3.57	4.00	**14816**
0.06	0.89	1.90	4.31	4.10	1.28	3.27	1.97	6.52	6.00	4.55	5.00	0.90	3.65	4.00	**14832**
0.14	0.49	0.57	1.66	1.64	5.56	2.83	0.82	9.21	9.00	8.39	8.00	2.83	2.83	3.00	**14526**
0.10	0.32	0.58	1.59	1.64	5.31	3.19	0.81	9.31	9.00	8.50	8.00	3.04	3.04	3.00	**14876**
0.12	0.65	0.77	2.50	2.46	5.21	2.76	1.46	9.43	9.00	7.97	8.00	2.83	2.83	3.00	**14547**
0.08	0.65	1.66	3.37	3.30	2.06	5.60	1.32	8.98	8.00	7.66	8.00	4.98	4.98	4.00	**14841**
0.16	0.58	3.19	4.37	4.11	0.57	4.20	0.65	5.42	4.00	4.77	4.00	0.90	4.52	4.00	**14766**
none	0.44	3.15	4.38	4.11	0.71	4.03	0.22	4.96	4.00	4.74	4.00	0.56	4.29	4.00	**14991**
. .	. .	. .	4.30	4.11	..	..	..	4.84	4.00	...	...	..	4.07	4.00	**15155**
0.16	0.55	0.92	2.45	2.45	2.83	5.61	1.60	10.04	8.00	8.44	8.00	2.69	2.69	2.00	**14842**
1.24	0.54	0.77	2.67	2.46	5.54	2.49	0.69	8.72	9.00	8.03	8.00	4.13	4.13	4.00	**14767**
0.06	0.96	1.73	4.22	4.10	0.49	5.14	1.78	7.41	6.00	5.63	5.00	0.98	3.92	4.00	**15151**
0.04	0.30	0.45	0.92	0.82	6.88	3.50	1.11	11.49	11.00	10.38	10.00	1.03	1.03	1.00	**15107**
0.39	0.54	0.63	1.81	1.64	2.30	3.98	1.43	7.71	9.00	6.28	8.00	2.02	2.02	2.00	**14964**
0.34	0.27	0.96	1.77	1.64	5.77	3.19	0.47	9.43	8.00	8.96	7.00	2.35	2.35	2.00	**14959**
0.90	0.60	1.20	2.92	3.29	4.37	3.34	0.86	8.57	...	7.71	8.00	4.00	4.00	4.00	**14856**
0.67	0.58	1.56	2.90	2.47	6.10	3.23	1.48	10.81	...	9.33	8.00	3.53	3.53	4.00	**14871**
0.65	0.71	1.47	2.95	4.53	6.07	3.38	1.50	10.95	...	9.45	8.00	3.50	3.50	3.00	**14857**
0.15	0.12	0.85	2.07	2.47	6.06	1.93	0.68	8.67	...	7.99	8.00	2.99	2.99	3.00	**14963**
0.20	0.42	1.01	2.73	3.29	5.09	2.73	0.84	8.66	...	7.82	8.00	4.18	4.18	4.00	**14962**
0.21	0.54	0.54	1.40	1.65	5.15	2.99	0.97	9.11	...	8.14	8.00	2.60	2.60	2.00	**14961**
1.41	0.53	0.68	3.35	4.00	6.05	2.24	0.60	8.89	8.50	8.29	8.00	3.95	3.95	4.00	**15208**

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton
	Sampled by Station:		
	Rogers and Hubbard Co., Middletown, Conn.		
14924	Hubbard's Bone Base Fertilizer for Seeding Down	Newington	$61.
14616	Hubbard's Bone Base Oats and Top Dressing	Hazardville	85.
14883	*Hubbard's Bone Base Oats and Top Dressing	Hamden	86.5
14716	Hubbard's Bone Base Soluble Corn and General Crop Manure	Hazardville	62.
14884	Hubbard's Bone Base Soluble Potato Manure	Hamden	79.7
14617	Hubbard's Bone Base Soluble Potato Manure	Hazardville	79.
14834	R. and H. All Soils-All Crops Phosphate	Hamden	74
15015	R. and H. Climax Tobacco Brand	Glastonbury	
14719	R. and H. Complete Phosphate	Middletown	50
14726	R. and H. Potato Phosphate	Hazardville	53
14838	R. and H. Soluble Tobacco Manure	Gildersleeve	[illegible]
14837	R. and H. Tobacco Grower, Vegetable Formula	Gildersleeve	100
	F. S. Royster Guano Co., Baltimore, Md.		
14777	Arrow Head Tobacco Formula	New Milford	93
14946	Banner Guano	Putnam	76
14544	†Bully Guano	Waterbury	65.
14867	Dreadnought Guano	Naugatuck	59
14771	‡Fish, Flesh and Fowl Guano	Shelton	54
15358	Fish, Flesh and Fowl Guano	Branford	54.
14578	Fish and Potash	Waterbury	55.
14927	†Quality Trucker	Putnam	79
14868	†Truckers' Delight	Glastonbury	
14878	Valley Tobacco Formula	Glastonbury	
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.		
14637	Atlantic Coast Bone, Fish and Potash	Meriden	46.5
14768	Complete Tobacco Grower	Glastonbury	85
14634	Corn Superphosphate	Meriden	43.7
14720	Formula "A"	Guilford	65
15129	Formula "B"	Milford	
14580	Potato Manure	Milford	
14636	Potato Manure	Meriden	54 7
14925	Top Dressing for Grass and Grain	Glastonbury	
14917	South American Sheep and Goat Manure	New Canaan	50
14922	Kelsey's Bone, Fish and Potash	Clinton	59
	M. L. Shoemaker and Co., Philadelphia, Pa.		
14835	Swift-Sure Superphosphate for General Use	Meriden	55
14836	Swift-Sure Superphosphate for Potatoes No. 1	Meriden	67

*See note, page 59. †See note, page 56. ‡See note, page 57.

WITH POTASH—(*Continued*).

Nitrogen.					Phosphoric Acid.							Potash.		
In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		As muriate.	Total.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.			
0.27	0.34	2.17	2.78	2.46	0.08	7.75	8.26	16.09	15.00	7.83	6.00	4.35	4.35	4.00
0:08	0.44	0.88	8.04	8.22	0.54	4.92	2.92	8.38	8.00	5.46	3.00	4.00	4.00	4.00
0.04	0.77	1.21	8.24	8.22	0.07	5.06	2.37	7.50	8.00	5.13	3.00	4.50	4.50	4.00
0.18	0.14	0.51	2.33	2.46	1.69	7.07	1.82	10.58	10.00	8.76	8.00	4.49	4.49	4.00
0.18	0.58	0.61	4.29	4.11	1.64	6.71	1.48	9.83	10.00	8.35	8.00	1.22	6.27	6.00
0.25	0.68	0.78	3.96	4.11	0.12	8.49	2.75	11.36	10.00	8.61	8.00	1.57	5.94	6.00
0.59	0.45	0.58	3.07	3.29	3.28	5.56	1.43	10.27	9.00	8.84	8.00	6.50	6.50	6.00
none	0.51	1.63	4.31	4.11	0.76	2.90	2.19	5.85	5.00	3.66	4.00	0.78	2.96	3.00
0.11	0.01	0.36	0.80	0.82	4.19	4.69	1.42	10.30	9.00	8.88	8.00	2.14	2.14	2.00
0.16	0.13	0.50	1.63	1.64	3.23	5.47	1.30	10.00	9.00	8.70	8.00	4.35	4.35	4.00
0.26	0.56	1.70	4.76	4.93	1.17	7.70	2.99	11.86	10.00	8.87	8.00	1.08	4.44	4.00
0.09	0.41	3.42	4.99	4.93	0.76	4.41	0.68	5.85	5.00	5.17	4.00	1.10	3.94	4.00
0.83	0.05	2.70	4.08	4.11	2.28	1.67	0.35	4.30	4.50	3.95	4.00	0.24	2.88	3.00
0.90	0.14	0.50	1.62	1.65	6.41	2.06	1.24	9.71	8.50	8.47	8.00	8.91	8.91	10.00
0.68	0.13	0.52	1.59	1.65	5.55	1.94	0.95	8.44	8.50	7.49	8.00	4.72	4.72	5.00
0.91	0.28	0.50	1.74	1.65	5.96	1.85	0.90	8.71	8.50	7.81	8.00	2.00	2.00	2.00
0.67	none	0.56	1.54	1.65	6.25	1.49	1.05	8.79	8.50	7.74	8.00	2.54	2.54	3.00
..	..	..	1.58	1.65	6.41	2.20	0.31	8.92	8.50	8.61	8.00	2.83	2.83	3.00
0.95	0.09	0.71	1.87	1.65	5.86	1.45	1.38	8.69	8.50	7.31	8.00	1.00	1.00	1.00
2.02	0.46	0.47	3.06	3.30	5.72	2.71	1.29	9.72	8.50	8.43	8.00	5.78	5.78	7.00
1.74	0.44	0.71	3.04	3.30	5.53	2.46	1.18	9.17	8.50	7.99	8.00	3.64	3.64	4.00
0.82	0.06	2.46	3.87	4.11	2.33	2.05	0.40	4.78	4.50	4.38	4.00	0.30	5.20	5.00
0.15	0.58	0.99	1.79	1.65	3.45	4.98	2.03	10.46	9.00	8.43	8.00	3.08	3.08	3.00
0.07	0.11	3.38	4.53	4.11	0.91	4.40	0.23	5.54	5.00	5.31	4.00	1.00	4.15	5.00
0.37	0.62	0.82	2.07	1.65	4.67	3.96	1.16	9.79	9.00	8.63	8.00	1.88	1.88	2.00
1.32	0.99	1.24	3.71	3.29	4.47	3.92	1.56	9.95	9.00	8.39	8.00	3.17	3.17	4.00
none	0.96	1.77	3.87	3.29	6.75	3.09	1.02	10.86	9.00	9.84	8.00	4.52	4.52	4.00
0.42	0.64	0.84	2.48	2.47	5.08	3.72	1.11	9.91	9.00	8.80	8.00	3.81	3.81	4.00
0.13	0.64	1.13	2.65	2.47	5.22	2.90	1.78	9.90	9.00	8.12	8.00	4.05	4.05	4.00
0.91	1.30	1.76	4.04	4.11	6.34	3.01	2.00	11.35	9.00	9.35	8.00	4.19	4.19	4.00
0.18	1.25		1.43	1.23	0.05	1.00	0.13	1.18	1.00	1.05	.....	2.27	3.12	3.00
0.76	0.49	1.83	3.61	2.47	6.30	2.99	1.56	10.85	11.00	9.29	10.00	4.68	4.68	3.00
none	0.47	1.44	2.52	2.46	4.94	3.63	2.53	11.10	11.00	8.57	8.00	3.72	3.72	3.00
0.12	0.73	1.63	3.11	3.30	7.47	2.71	1.64	11.82	11.00	10.18	8.00	4.44	4.44	5.00

TABLE VIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash
	Sampled by Station:		
	Springfield Rendering Co., Springfield, Mass.		
14642	Animal Brand	Thompsonville	$62
14919	Grain and Grass	Suffield	50
14920	Tobacco Special	Hazardville	58
	Virginia-Carolina Chemical Co., New York City.		
14724	Challenge Brand	Hartford	56
14725	Champion Brand	Hartford	70
14966	Cherokee Brand	Glastonbury	78
14968	Indian Chief Brand	Glastonbury	83
14967	Owl Brand	Glastonbury	..
15084	Plant Food for Vegetables, Lawns and Flowers	Waterbury	..
	Wilcox Fertilizer Co., Mystic, Conn.		
14577	Corn Special	Branford	64
15123	*Fish and Potash	Branford	56
14721	Grass Fertilizer	Mystic	65
14717	High Grade Fish and Potash	Burnside	..
14576	Potato Fertilizer	Branford	53
14723	*Potato and Vegetable Phosphate	Jewett City	68
15012	Tobacco Special	Ellington	81
	S. D. Woodruff and Sons, Orange, Conn.		
14498	Home Mixture	Orange	58
	Worcester Rendering Co., Auburn, Mass.		
14928	Prosperity Brand Royal Worcester Corn and Grain Fertz.	Putnam	48
14926	†Prosperity Brand Royal Worcester Potato and Vegetable Fertz	Willimantic	66
14960	Prosperity Brand Royal Worcester Special Grain Fertz.	Greenville	48
	The World's Fertilizer Process Co., Sharpsburg, Pa.		
14769	Shur-Gro	Hartford	..
	Sampled by Purchaser:		
15330	American Ag'l Chem'l Co. 5–8–7	Winsted	80
14783	Apothecaries Hall Co.'s Liberty Brand 4–8–4	Branford	65
15143	Atlantic Packing Co.'s Potato Phosphate 3–8–4	Westville	..
15089	‡Berkshire Tobacco Starter	Suffield	98
14752	Frisbie's 4–8–4	Milford	58
14804	Frisbie's 5–5–4	Somers	..
14682	Frisbie's Bone Base 4–8–4	Woodmont	..
15087	Mapes' Corn Manure	Hartford	..

*See note, page 59. †See note, page 56. ‡See note, page 57.

WITH POTASH—(*Continued*).

Nitrogen.						Phosphoric Acid.							Potash.			
In nitrate	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		As muriate.	Total.	Guaranteed.	Station N
				Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.				
ne	0.84	1.24	0.68	2.76	2.46	4.92	3.31	0.88	9.11	9.00	8.23	8.00	4.38	4.38	4.00	146
25	0.35	0.68	0.53	1.81	1.64	5.26	3.19	0.40	8.85	9.00	8.45	8.00	2.39	2.39	2.00	149
41	0.08	1.08	1.75	4.32	4.10	1.50	3.40	1.88	6.78	6.00	4.90	5.00	0.80	4.03	4.00	149
08	0.15	0.26	0.48	0.97	0.82	7.07	2.26	1.28	10.61	...	9.33	9.00	3.04	3.04	3.00	147
16	1.07	0.67	1.30	3.20	3.29	5.47	3.02	1.18	9.67	...	8.49	8.00	4.19	4.19	4.00	147
26	0.86	0.35	3.23	4.70	4.11	1.84	1.95	0.20	3.99	...	3.79	4.00	0.30	3.33	3.00	149
19	1.09	0.35	2.73	4.36	4.11	2.29	1.70	0.32	4.31	...	3.99	4.00	0.51	7.18	5.00	149
06	0.08	0.37	0.27	1.78	1.65	5.97	1.67	0.65	8.29	...	7.64	8.00	2.57	2.57	3.00	149
24	3.27	0.13	1.40	5.04	4.94	5.26	3.22	1.92	10.40	...	8.48	8.00	0.90	1.77	2.00	150
33	0.65	none	2.80	3.78	3.29	3.42	5.24	3.89	12.55	9.00	8.66	8.00	0.45	2.67	2.00	145
19	0.27	0.34	1.76	2.56	2.46	6.36	2.60	0.51	9.47	9.00	8.96	8.00	1.33	1.33	1.00	151
87	0.16	0.25	1.73	4.01	4.12	5.64	2.38	0.40	8.42	9.00	8.02	8.00	2.23	2.23	2.00	147
86	0.29	0.30	1.37	2.82	2.46	6.27	2.42	0.24	8.93	9.00	8.69	8.00	3.26	3.26	3.00	147
37	0.13	0.23	1.46	2.19	1.65	6.58	2.20	2.41	11.19	9.00	8.78	8.00	2.44	2.44	2.00	145
40	0.21	0.20	1.48	3.29	3.29	5.80	2.37	1.68	9.85	9.00	8.17	8.00	3.90	3.90	4.00	147
57	0.11	0.35	2.84	4.17	4.12	0.50	2.73	2.25	5.48	5.00	3.23	3.00	0.41	4.18	4.00	150
58	0.07	2.49		3.14	3.29	2.79	3.63	1.50	7.92	8.00	6.42	...	1.34	4.24	3.00	144
28	0.45	0.61	0.44	1.78	1.64	6.08	3.04	0.73	9.85	9.00	9.12	8.00	2.26	2.26	2.00	149
10	0.92	0.96	1.14	3.12	3.29	4.16	3.88	1.00	9.04	9.00	8.04	8.00	4.08	4.08	4.00	149
ne	0.06	0.51	0.38	0.95	0.82	7.12	3.25	1.14	11.51	11.00	10.37	10.00	1.04	1.04	1.00	149
–	..	..	..	0.13	..	0.62	6.81	0.54	7.97	5.50	7.43	5.00	0.40	2.00	2.00	147
98	1.27	0.60	0.59	3.44	4.13	5.57	3.77	1.01	10.35	...	9.34	8.00	5.54	6.12	7.00	153
28	1.07	0.72	1.51	3.58	3.29	5.55	2.62	0.82	8.99	...	8.17	8.00	3.86	3.86	4.00	147
–	..	..	..	2.44	2.47	..	..	..	8.16	9.00	...	...	...	4.06	4.00	151
00	0.02	1.96		4.98	5.00	0.54	2.99	0.09	3.62	5.00	3.53	4.00	1.71	7.56	8.00	150
–	..	..	..	3.09	3.28	..	..	1.11	9.17	9.00	8.06	8.00	..	3.68	4.00	147
–	..	..	..	..	..	..	..	..	...	...	...	...	0.70	4.00	4.00	148
–	..	..	..	3.40	3.29	4.19	3.51	1.15	8.85	...	7.70	8.00	..	4.26	4.00	146
–	..	..	..	2.66	2.47	..	..	..	10.29	10.00	...	...	..	3.10	3.00	150

from 12 bags remaining in T. F. Devine's stock. He found the bags wet on the outside, and the resulting analysis, No. **15444**, showing nitrogen 4.44, phosphoric acid 3.16, and potash 7.61 per cent., could not have represented the quality of the goods as sold.

BORAX IN COMMERCIAL FERTILIZERS.

Injury to farm crops caused by borax in the fertilizers used was first brought to serious attention by the experience of corn growers in Indiana in 1917. Later the same trouble was reported from the potato districts of Maine and cotton districts in the South. Evidence indicated that injury followed the use of fertilizers containing potash with considerable amounts of borax. The damage was greatest where the largest amount of potash had been applied; and also in fields where the fertilizer was drilled in with the seed and conditions resulted which left the seed in contact with the fertilizer too long.

The explanation of how borax acts to cause the effects noted is largely speculative at the present time. It has been suggested, and it appears quite plausible, that borax unites with some constituent of the nutrient juices in plants in such a way as to prevent or hinder the ready diffusion of food material to the various parts of the plant system. Interference with enzyme action and other causes have been suggested.

There are no data upon which to base an accurate statement as to the limits of tolerance to borax exhibited by plants. If such limits were definitely established they would be modified by varying field conditions. It was with a view to insuring an ample margin of safety that the Secretary of Agriculture issued an order[1] concerning borax in mixed fertilizers which limited the amount of boron, expressed as anhydrous borax, in any fertilizer or fertilizer ingredient sold for application to the soil to one-tenth of one per cent. unless the goods so sold were plainly marked to show the amount present.

During the past season all mixed fertilizers and potash and nitrate salts inspected by this Station have been examined for borax. Preliminary qualitative tests were made and these were followed by quantitative determinations in suspicious cases.

The qualitative test employed was substantially that proposed by Bartlett[2] but modified in this laboratory[3] in that the fertilizer suspension was more strongly acidified and the turmeric strips were dried out at room temperature to avoid the charring due to hydrochloric acid at the temperature of boiling water.

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[1] S. R. A., Bureau of Soils, Dec. 23, 1919.

[2] Maine Experiment Station.

[3] By Mr. C. E. Shepard.

Our procedure is as follows:

Digest about 5 grams of fertilizer with 10cc of water for 10 minutes on a steam bath. Acidify with 2cc of concentrated hydrochloric acid, stir thoroughly and allow to settle. Moisten a strip of turmeric paper with the supernatant liquid and allow to dry at room temperature or in a desiccator if the atmosphere is humid. Color due to boric acid is generally indicated in about 10 minutes and results may be noted within an hour.

For the quantitative determination of borax the methods of Ross and Deemer[1] and of J. M. Bartlett[2] have been used with about equally satisfactory results.

None of the brands examined at this Station during the past season contained borax in an amount likely to be injurious to crops unless applied close to the seed in large amounts, say 2,000 pounds per acre.

The brands in which more than one-tenth per cent. of borax was found were the following:

		Per cent. Borax.
15043	Hubbard's Noxall Guano	0.22
14742	Mapes' General Truck Manure	0.17
14653	Mapes' Potato Manure 1916 Brand	0.12
14883	R. & H.'s Hubbard's Bone Base Oats and Top Dressing	0.19
15123	Wilcox Fertilizer Co.'s Fish and Potash	0.14
14723	Wilcox Fertilizer Co.'s Potato and Vegetable Phosphate	0.18

During the winter and spring the Stations in the Northeastern States co-operated in carrying out elaborate potato experiments with corn, beans and potatoes, to study the action of borax on the growth of these crops. This experiment was conducted at the Vermont Station through the co-operation of Dr. J. L. Hills, Director, and was in direct charge of Mr. J. R. Neller.

A full account of this work is not yet ready for publication. Some of the more important results are briefly as follows:

Borax-containing fertilizers applied below the seed are much more liable to injure them than applied above the seed or broadcast.

One or two pounds of borax in the fertilizer were not harmful to either crop, whether broadcast or applied in the drill, but it was not conclusively shown that the five-pound application in the drill was harmless. Ten and twenty pounds of borax per acre were certainly injurious or ruinous.

Lime and gypsum, as well as manure, seemed partially to neutralize the poisonous action.

HOME-MIXED NITROGENOUS SUPERPHOSPHATES.

14782. Mixed by the Apothecaries Hall Co., Waterbury, to order of the A. E. Plant Sons Co., Branford. 200 lbs. nitrate of soda, 900 lbs. tankage, 900 lbs. phosphate.

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[1] Respectively, Bureau of Soils and Bureau of Plant Industry Washington, D. C.

[2] Maine Experiment Station.

15142. Mixed by the Apothecaries Hall Co., Waterbury, to order of Paul Cavanna, South Glastonbury. 2,800 lbs. nitrate of soda, 2,800 lbs. bone tankage (3-50), 4,200 lbs. acid phosphate, 4,200 lbs. cottonseed meal.

15092, 15094, 15095, 15097, 15099, 15101, 15102 and 15103. Mixed by A. L. Koster, Suffield, to order of the American Sumatra Tobacco Co., Hartford. Each analysis represents a sample taken from a car lot.

14713. Made by V. E. Lucchini, Meriden. Acid phosphate, nitrate of soda and tankage.

14714. Made by V. E. Lucchini, Meriden. Acid phosphate, nitrate of soda and tankage.

14427. Mixed by Olds & Whipple, Hartford, to order of American Sumatra Tobacco Co., Hartford.

15096. Mixed by Olds & Whipple, Hartford, to order of American Sumatra Tobacco Co., Hartford.

15098. Mixed by Olds & Whipple, Hartford, to order of American Sumatra Tobacco Co., Hartford.

15100. Mixed by Olds & Whipple, Hartford, to order of American Sumatra Tobacco Co., Hartford.

TABLE IX. ANALYSES OF HOME-MIXED NITROGENOUS SUPERPHOSPHATES.

Station No.	Nitrogen					Phosphoric Acid.					Pota	
	In nitrates.	In ammonia.	Organic water-soluble.	Organic water-insoluble	Total found.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total found.	So-called "Available" found.	As muriate.	Total found.
14782	1.83	0.14	0.74	1.30	4.01	6.36	3.79	4.23	14.38	10.15	......	......
15142	2.39	None	2.31		4.70	2.28	4.81	0.59	7.68	7.09	0.62	0.86
15092	None	1.08	4.26		5.34	0.92	4.83	0.92	6.67	5.75	1.73	4.31
15094	0.81	1.01	3.62		5.44	1.01	5.44	1.43	7.88	6.45	1.62	4.17
15095	0.91	0.80	3.17		4.88	1.10	5.89	1.73	8.72	6.99	2.13	3.80
15097	0.70	1.00	3.33		5.03	0.81	5.26	1.82	7.89	6.07	1.42	3.98
15099	0.97	0.77	3.62		5.36	0.82	5.51	0.96	7.29	6.33	1.62	4.58
15101	0.80	0.72	3.77		5.29	0.88	5.17	0.83	6.88	6.05	1.20	3.55
15102	0.69	1.00	3.15		4.84	0.86	5.12	1.89	7.87	5.98	1.46	4.24
15103	0.90	0.75	3.08		4.73	0.72	4.98	1.45	7.15	5.70	1.54	4.40
14713	.....	.....	.....	.....	5.33	4.63	4.07	4.63	13.33	8.70	......	......
14714	.....	.....	.....	.....	4.19	4.68	4.49	5.00	14.17	9.17	......	......
14427	.....	.....	.....	.....	5.99	0.50	5.61	0.17	6.28	6.11	......	1.37
15096	0.77	0.07	5.56		6.40	1.30	4.37	0.19	5.86	5.67	0.52	1.33
15098	0.57	0.07	5.34		5.98	1.17	4.51	0.23	5.91	5.68	0.70	1.40
15100	0.72	0.04	5.34		6.10	1.29	4.52	0.20	6.01	5.81	0.53	1.45

VI. MISCELLANEOUS FERTILIZERS AND WASTE PRODUCTS.

TOBACCO STEMS AND DUST.

Four samples were analyzed as follows:

14382. Tobacco Stems. Sent by the Everett B. Clark Seed Co., Milford.

14309. Stem Butts. Sent by Morgan & Dickinson, Windsor.

14310. Tobacco Dust. Sent by J. N. Root, W. Suffield.

14429. Tobacco Stems. Sent by Gordon Scholes, Warehouse Point.

ANALYSES OF TOBACCO STEMS AND DUST.

Station No.	**14382**	**14309**	**14310**	**14429**
Nitrogen	2.28	1.59[1]	2.20[2]	3.13
Phosphoric acid	0.32	0.40	0.47	....
Potash (total)	4.86	4.50	2.14	7.86

[1] 0.47 nitrogen in nitrates.
[2] 0.66 nitrogen in nitrates.

LIME-FERTILE AND NITRO-FERTILE.

14485. Lime-Fertile, made by Fertile Chemical Co., Cleveland, Ohio. Stock of A. R. Brewer, Hartford.

14538. Nitro-Fertile, made by Fertile Chemical Co., Cleveland, Ohio. Stock of Church & Morse, Meriden.

ANALYSES OF LIME-FERTILE AND NITRO-FERTILE.

Station No.	**14485**		**14538**	
	Found	Guaranteed	Found	Guaranteed
Nitrogen as nitrates	....	....	1.12	....
Nitrogen (total)	....	....	2.08	2.00
Phosphoric acid	3.17	3.00	3.48	3.00
Potash calculated as sulphate	....	....	1.71	....
Potash calculated as muriate	....	....	2.60	....
Potash (total)	....	....	4.31	3.00
Lime	28.65	....	....	....

Nitro-fertile is a solution for use on potted plants, costing 35 cents per half-pint, and Lime-fertile is also sold in small packages, five pounds for 25 cents. The plant food in a package, at the ordinary rates for fertilizers, is worth at most about 2½ cents.

SHEEP MANURE.

Nine samples were analyzed as follows:

14519. Pulverized Sheep Manure. Sold by American Agricultural Chemical Co., New York City. Stock of Southington Lumber Co., Southington.

14521. Liberty Brand Sheep Manure. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

15159. Sheep Manure. Berkshire Fertz. Co., Bridgeport. Sampled at factory.

15108. Rams Head Brand. Sold by Joseph Breck & Sons Corp., Boston. Stock of G. M. Williams Co., New London.

14613. Magic Brand Pulverized Sheep Manure. Sold by Chicago Feed & Fertz. Co., Chicago, Ill. Stock of Blish Hardware Co., South Manchester.

14770. "Sheep's Head" Pulverized Sheep Manure. Sold by Natural Guano Co., Aurora, Ill. Stock of Cadwell & Jones, Hartford.

15041. Groz-It Brand Sheep Manure. Sold by Pacific Manure and Fertilizer Co., San Francisco, Calif. Stock of F. M. Cole, Putnam.

14523. Wizard Brand Sheep Manure. Sold by Pulverized Manure Co., Chicago, Ill. Stock of S. P. Strople, New Britain.

14579. Sheep Manure. Sold by S. D. Woodruff & Sons, Orange. Stock of Rackliffe Bros Co., New Britain.

TABLE X. ANALYSES OF SHEEP MANURE.

Station No.	**14519**	**14521**	**15159**	**15108**	**14613**	**14770**	**15041**	**14523**	**14579**
Per cent. of									
Nitrogen as nitrates	None	0.14	0.12	.....	0.14	None	0.17	None	0.11
" " ammonia	0.45	0.09	0.18	0.50	0.09	0.40	0.05	0.10	0.19
" organic	2.25	1.32	1.91	2.09	1.47	2.10	1.28	1.65	1.31
" total found	2.70	1.55	2.21	2.59	1.70	2.50	1.50	1.75	1.61
" " guaranteed	2.06	1.50	1.70	1.84	1.85	2.25	1.84	1.80	1.50
Phosphoric acid, water-soluble	0.98	0.26	0.13	0.94	0.06	0.95	0.11	0.34	0.24
Phosphoric acid, citrate-soluble	0.55	0.45	1.70	0.77	0.67	0.84	0.73	0.77	0.57
Phosphoric acid, citrate-insoluble	0.12	0.17	0.10	0.09	0.19	0.13	0.03	0.14	0.14
Phosphoric acid, total found	1.65	0.88	1.93	1.80	0.92	1.92	0.87	1.25	0.95
Phosphoric acid, total guarteed	1.25	1.00	1.00	1.25	1.43	1.25	1.25	1.00	1.00
Water-soluble potash found	2.37	3.36	2.14	2.43	3.57	2.60	3.39	2.17	3.20
Water-soluble potash guaranteed	1.00	2.00	1.00	3.00	1.25	1.50	3.00	1.00	2.50
Chlorine	0.89	1.58	.....	0.84	2.30	0.53	1.73	0.44	1.86
Cost per ton	$33.00	35.00	40.00	65.00	50.00	48.00	48.00	57.00	55.00

14613. Magic Brand, and **15041** Groz-It Brand, fail to meet their guaranties of nitrogen and phosphoric acid.

Sheep manure, being fine and dry, is well adapted to greenhouse work and for a dressing for lawns.

A comparison with New York horse manure is as follows:

Pounds of the ingredients named in one ton.

	Sheep Manure	Horse Manure
Organic matter	1426	540
Nitrogen	40	13
Phosphoric acid	27	9
Potash	56	12

Three and one-half tons of horse manure contain on the average as much plant food as does one ton of sheep manure.

The prices quoted by dealers range from $33 to $65 per ton, the higher prices probably are quoted for sales in small quantities.

It is doubtful if sheep manure will promote bacterial activity in the soil as effectively as fresh manures, but if the cost of fresh manure rises much further the dried manures may come into use on the farm where it is felt that manure must be used.

LIME AND LIME-KILN ASHES.

14235. Agricultural Lime. Sold by Grangers' Agricultural Lime Co., West Stockbridge, Mass. Sent by E. H. Ocain, Falls Village.

14629. Lime. Sent by Raymond Bros., South Norwalk.

14803. Ground Limestone. Sold by the Stearns Lime Co., Danbury. Sent by C. R. Treat, Orange.

15161. Lime-Kiln Ashes. Sent by A. B. Smith, Clintonville.

Analyses of Lime and Lime-Kiln Ashes.

Station No.	14235	14629	14803	15161
Water-soluble potash	......	......	......	2.17
Lime	39.74	37.50	38.56	41.34
Insol. in acid	13.58	......	25.68	14.71

14803 was stated by Mr. Treat to have a guaranty of 45 per cent. calcium oxide and 75 per cent. to pass a 100-mesh screen. Only 60 per cent. of the sample passed such a screen.

The manufacturers state that the hard winter and the great demand for lime made it necessary to fill orders as best they could, and some lime of inferior quality like **14803** got shipped out which was quite inferior to the normal product.

In the last ten years ten analyses of lime from this firm show percentages of lime ranging from 43.44 to 47.36 and averaging 45.43 per cent. of lime, equivalent to 81.1 per cent. of calcium carbonate, with 3.23 per cent. of magnesia.

WOOD ASHES.

In a table, page 65, are given analyses of wood ashes.

15106 is from the furnace of the Cheshire Mill.

14646 was sent by R. S. Griswold, who stated that the ashes were bought of A. E. Dickenson & Co., of Essex, with a guaranty that they should be as good as those bought the year before.

This sample contained 32.18 per cent. of insoluble matter and only 1.31 per cent. of water-soluble potash.

Later the sampling agent of the Station drew a sample of these ashes at Mr. Griswold's request, the analysis of which appears as No. **15086**.

Ten car lots of ashes from John Joynt, Lucknow, Can., six of them sold to the American Sumatra Tobacco Co., Nos. **14844** to **14848** and **15093**, and four other car lots, Nos. **14252, 14467, 14985** and **15017**, were of excellent quality.

But three other samples from the same dealer were of very inferior composition, **14513, 14888** and **14984**.

15367 from Geo. Stevens, Peterborough, Can., is not *unleached* hard wood ashes.

At $5.50 per unit, potash in wood ashes costs 27 cents per pound, at $6.00 per unit, potash costs 30 cents per pound. This is about double the cost in potash salts mentioned on page 25. Ashes, however, contain 1.5 to 2.0 per cent. of phosphoric acid and about 30 per cent. of lime in form of carbonate, which add considerably to their value.

14987. Phos-Pho-Germ. Made by the American Nitro-Phospho Corporation, 80 Lafayette St., New York City.

It is claimed to be a mixture of humus, raw phosphate, lime, wood ashes, sulphur and various bacterial foods, and inoculated with many strains of vigorous, beneficial soil bacteria.

The sample drawn by a Station agent from stock of George Yuengling, New Canaan, had a guaranty of 0.82 per cent. nitrogen, 8.00 per cent phosphoric acid, of which 0:25 is available, and 0.15 per cent. of potash.

The analysis is as follows:

Per cent. of	
Nitrogen	0.50%
Available phosphoric acid	1.16
Total phosphoric acid	17.27
Potash	0.22
Cost per ton	$45.00

It fails to meet its guaranty of nitrogen. The plant food in a ton of it is, liberally estimated, worth about $15. Whether the "vigorous, beneficial soil bacteria" in a ton of it are worth $30, the difference between the value of the plant food and the ton price, may well be doubted.

A sample stated to be Cocoon Dust, **15214,** sent by the National Spun Silk Co. of New Bedford, Mass., contained 8.99 per cent. of nitrogen in fairly soluble and available condition, 1.41 per cent. of phosphoric acid and 0.25 per cent. of potash with 83.13 per cent. of organic matter; apparently an excellent nitrogenous fertilizer.

15210. Wool Waste from A. B. Smith, Clintonville. Contained 1.35 per cent. nitrogen, probably in inert form.

TABLE XI. ANALYSES OF WOOD ASHES.

Car No. and Dealer or Purchaser.	Insoluble in acid (sand).	Water-soluble, potash.	Lime.	Phosphoric acid.	Cost per ton.
Car C. G. R. No. 250022 Frank Bailey, Barre, Vt. Frank N. Brockett, Suffield	21.78	4.20	25.85	1.47	$25.00
Conn. Brass & Mfg. Corp., Waterbury	7.96	4.72	43.76	2.70	......
E. E. Dickenson & Co. R. S. Griswold, Wethersfield	32.18	1.31	16.37	1.54	......
E. E. Dickenson & Co. R. S. Griswold, Wethersfield	......	1.84	16.82	1.71	......
Car No. 201591. John Joynt, Lucknow, Ont. American Sumatra Tobacco Co., Bloomfield	20.50	6.05	30.24	2.02	(1)
Car No. 19698. John Joynt, Lucknow, Ont. American Sumatra Tobacco Co., Bloomfield	10.40	5.63	36.98	2.24	(1)
Car No. 16567. John Joynt, Lucknow, Ont. American Sumatra Tobacco Co., Bloomfield	12.90	7.18	34.80	2.26	(1)
Car No. 6920. John Joynt, Lucknow, Ont. American Sumatra Tobacco Co., Bloomfield	16.69	6.50	31.74	2.19	(1)
Car No. 4067. John Joynt, Lucknow, Ont. American Sumatra Tobacco Co., Bloomfield	15.12	6.63	32.00	2.41	(1)
Car No. 11609. John Joynt, Lucknow, Ont. John Wolf, Windsor	10.04	4.79	31.67	1.00	(2)
Car No. 80633. John Joynt, Lucknow, Ont. J. N. Lasbury, Broad Brook	12.65	4.96	28.03	1.59	......
John Joynt, Lucknow, Ont. A. D. Bridge Sons Co., Hazardville	25.41	1.42	18.55	0.58	22.00
Car No. 243740. John Joynt, Lucknow, Ont. Geo. T. Soule, New Milford	27.58	0.52	21.21	1.66	26.00
John Joynt, Lucknow, Ont. Geo. T. Soule, New Milford	21.34	0.85	28.70	1.33	26.00
Car No. 84738. John Joynt, Lucknow, Ont. N. Jones, South Windsor	13.30	5.72	31.64	2.02	(1)
Car No. 50110. John Joynt, Lucknow, Ont. N. Jones, South Windsor	23.35	4.63	26.18	2.26	(1)
Car No. 10301. John Joynt, Lucknow, Ont. American Sumatra Tobacco Co., Hartford	13.34	6.56	34.27	2.06	......
Geo. Stevens, Peterborough, Can. F. W. Judson, Waterbury	16.22	0.88	......	3.99	15.00
From Chase Metal Works, Waterbury. Sent by A. F. Greene, Woodbury	9.08	5.49	......	1.61	......

5.50 per unit of water-soluble potash. [2] $6.00 per unit of water-soluble potash.

14753. Stated to be "a factory waste." Sent by F. A. Jordan, Woodstock. Contained 7.63 per cent. of nitrogen, .40 per cent. of which was in form of ammonia and all of which appeared to be in available form.

14939. Stated to be Chili Saltpeter. Guaranteed 15.50 per cent. nitrogen and 17.20 per cent. potash.

It contained 11.38 per cent. of nitrogen, 17.05 per cent. of potash, and 0.38 per cent. of borax. It is apparently a waste product from the refining of nitrate of soda.

14940. Stated to be a residue from a Welsbach burner factory and sent by Prof. Browning of Yale University. It contained:

Water-soluble phosphoric acid	0.50%
Citrate-soluble phosphoric acid	16.90
Citrate-insoluble phosphoric acid	10.78
Total phosphoric acid	28.18

14916. Stated to be a solution in which refuse rubber is heated under steam pressure.

It had a sp. gr. of 1.017, contained 2.86 per cent. of solid matter, 1.21 per cent. of potash and a little combined sulphur. Of no value as an insecticide or fungicide.

13575. Thought to be wood ashes, contained 33.63 per cent. of insoluble matter, 0.77 per cent. of phosphoric acid and 0.45 of potash.

14937. A sample of fresh menhaden fish. They contain an average of water 77.0 per cent., oil 4.00 per cent., nitrogen 1.5, phosphoric acid 1.5, and potash 0.3 per cent.

14399. A mixture of several brands of fertilizer. Sent by F. J. Harrison, Waterbury. Contained 0.88 per cent. nitrogen, 14.90 of phosphoric acid and 0.07 of potash.

Five other samples were examined qualitatively, but have no general interest of importance.

DIRECTIONS FOR PREPARING INSECTICIDES AND FUNGICIDES.

FORMULAS FOR INSECTICIDES.

LEAD ARSENATE.

3 lbs. (Paste) or 1½ lbs. (Dry) Lead Arsenate and 50 gals. Water.

Spray upon foliage to kill all chewing insects. May be used with Bordeaux or with lime-sulphur mixture.

PARIS GREEN.

1 lb. Paris Green. 3 lbs. Lime.
100 gals. Water.

Spray upon foliage to kill potato beetle, elm leaf beetle, and all chewing insects. Commonly used with Bordeaux mixture on potatoes, largely superseded by lead arsenate.

CALCIUM ARSENATE.

1½ lbs. Dry Calcium Arsenate. 1½ lbs. Dry Air-Slaked Lime.
50 gals. Water.

Applied as dust or spray on potatoes. May be used in Bordeaux mixture. Not safe on fruit trees.

POISONED BRAN MASH.

5 lbs. Wheat Bran. 4 oz. White Arsenic or Paris Green.
1 pint Cheap Molasses. 1 Lemon. 7 pints Water.

Mix to form a dry mash and scatter around in field to kill cut-worms, army worms and grasshoppers.

HELLEBORE.

Dust on the plants, or mix with water, 1 oz. in 2 gals. and spray. For currant-worm and other saw-fly larvae.

LIQUID LIME-SULPHUR.

Winter Spray.

1 part Lime and Sulphur. 9 parts Water.

Summer Spray.

1¼ to 1½ parts Lime and Sulphur. 45 to 50 parts Water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

NICOTINE SOLUTION.

½-¾ pint in 50 gals. Water. Dissolve a 1 inch cube of Laundry Soap and add for a Spreader.

Several solutions are now sold containing 40% or more of nicotine. Excellent for killing aphids and other sucking insects.

KEROSENE EMULSION.

2 gals. Kerosene. 1 lb. Common Soap. 1 gal. Water.

Dissolve the soap in hot water, add the kerosene, and churn together with pump until a white creamy mass is formed which thickens on cooling. Dilute *nine* times before using for most aphids, but may be used stronger or weaker.

MISCIBLE OILS.

Several miscible oils are on the market, such as "Scalecide" and "Jarvis Compound," for killing San José scale, especially on old apple trees, mix 1 part in 15 parts water.

COMMON LAUNDRY SOAP.

Spray 1 lb. dissolved in 8 gals. water upon foliage to kill red spider, aphids, and other sucking insects.

CARBON DISULPHIDE.

To kill insects infesting stored grain, in tight bins, use 1 lb. for about 100 cubic feet of space. Expose for about 36 hours.

PARADICHLOROBENZENE.

A granular solid chemical which gives off fumes fatal to insect life. Has recently been used successfully to control the peach borer.

NAPHTHALENE.

Used in the form of moth-balls and "flakes" to keep clothes moths out of clothing. "Flakes" scattered around the borders of floors and shelves will drive away ants.

FORMALIN FLY POISON.

1 tablespoonful Commercial Formalin. ½ cup Sweet Milk.
½ cup Water.

Mix and expose in a shallow plate with a slice of bread in it. Flies will drink the liquid, especially if no other moisture is accessible, and be killed.

ANT POISON.

Arsenate Soda 125 grains. Sugar 1 pound. Honey 1 tablespoonful.
Water 1 quart.

Add arsenate soda and sugar to water. Boil until both are dissolved, then add honey. When cool, place in shallow dishes with a crust of bread or bits of sponge.

HYDROCYANIC ACID GAS.

1 oz. Sodium Cyanide. 2 oz. Sulphuric Acid. 4 oz. Water.
For each 100 cu. ft. space.

For fumigating dormant nursery stock or buildings, place the acid and water in an earthen jar in the house, drop in the cyanide and close the house at once for half an hour. Ventilate for ten minutes before entering. In greenhouse use 1 oz. of cyanide for each 1000 cu. ft. of space; avoid sunlight; excessive moisture; driving winds. Fumigate, between 52° and 70°F.

FORMULAS FOR COMMON FUNGICIDES.

LIQUID LIME-SULPHUR.

Winter Spray.
1 part Lime and Sulphur. 9 parts Water.
Summer Spray.
1¼ to 1½ parts Lime and Sulphur. 45 to 50 parts Water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

DRY LIME-SULPHUR.

There are now on the market several forms of lime-sulphur or similar fungicides, such as B. T. S., that because of convenience in shipping and handling are replacing somewhat the more bulky liquid fungicides. Where experience has shown that spray injury does not result from their use, they may well be substituted for the latter. Use according to directions given by the manufacturers.

SELF-BOILED LIME-SULPHUR.

8 lbs. Fresh Whitewash Lime.
8 lbs. Fine Sulphur. 45 to 50 gals. Water.

Start the lime slaking, sift and thoroughly stir in the sulphur, using just enough water to prevent burning and allow to boil from heat of lime for fifteen minutes. Then dilute and apply.

A very excellent substitute for this fungicide is the commercial article called "Atomic Sulphur," especially on peaches where it should be used without lead arsenate at the rate of 8 lbs. to 50 gallons water.

SULPHUR DUST.

Dusting with special grades of very fine sulphur, about 90 parts thoroughly mixed with 10 parts lead arsenate for apples and 80 parts sulphur and 20 parts air-slaked lime for peaches, or with special material prepared by manufacturers, has attained some prominence as a combined fungicidal and insecticidal treatment for fruit trees. Experience so far in this state seems to show that such treatment is much more effective in controlling insects than fungous troubles of the apple. Good results in controlling peach scab and fair results for brown rot are claimed by some authorities. Dusting is much quicker and so cheaper as regards labor, but the cost of material used is considerably greater.

BORDEAUX MIXTURE.

4 lbs. Copper Sulphate.
4 lbs. Fresh Lime. 40 to 50 gals. Water.

Dissolve the copper sulphate in hot water or from a coarse bag suspended in cold water; slake the lime separately and strain. Dilute the latter to about 20 gals., into which pour the copper sulphate, diluted to about 20 gals., stirring the mixture; dilute further to form the forty-five or fifty gallons; or dilute each to 25 gals., and pour together into barrel.

Stock solutions of the copper sulphate and lime, rate 1 lb. to 1 gal. water, can be made separately and used as needed. In this case four gallons of the stock lime is strained into the spray barrel while half filling it with water and then the four gallons of copper sulphate solution are gradually poured in as the barrel is filled to 50 gallons.

FORMALIN.

A. 1 pt. (1 lb.) formalin in 50 gals. water, for sprinkling grain to kill smut. See Smut under Oats.

B. 1 pt. undiluted formalin is *sprayed* directly on 50 bushels of grain as it is shoveled over and then heaped in a pile and covered for four hours.

C. 1 pt. formalin in 30 gals. water; soak uncut tubers 1 hour to prevent potato scab.

D. 1 pt. formalin in 12½ gals. water, for soil treatment. Use two-thirds to 1 gal. for each square foot of surface treated; cover for 24 hours after treatment; air afterwards and stir soil; allow 7-10 days before seeding and 10-14 days before transplanting in this soil.

4 oz. Corrosive Sublimate. 30 gallons Water.

Dissolve the corrosive sublimate at first in a small amount of *hot* water nd then dilute. Soak uncut seed potatoes in this for ½ to 1 hour. After ach treatment renew strength by adding 1 oz. of corrosive sublimate nd water as needed to retain the 30 gallons. Use in wooden containers nd mark *Poison*. Good for both scab and black scurf.

FORMULAS FOR LESS-USED FUNGICIDES.

OTHER BORDEAUX MIXTURES.

Dilute Bordeaux Mixture. Use 1 lb. copper sulphate, 4 of lime, and ake as above directed. For second and third sprayings of apples to ssen russeting of the fruit.

Soda Bordeaux Mixture. 4 lbs. copper sulphate, 1⅛ to 1½ lbs. soda e, 50 gals. water. Use only enough lye to make the solution alkaline test paper. Used sometimes for late spraying of grapes, etc., where ray sediment is objectionable. Care needed in making to avoid spray jury.

Resin Bordeaux Mixture. Melt 5 lbs. resin with 1 pt. fish oil, cool ightly, add 1 lb. soda lye, sitrring. Add 5 gals. water and boil till the ixture will dissolve in cold water. Mix 2 gals. with 48 of Bordeaux ixture. Used sometimes on such glaucous plants as asparagus, cabge, onions, etc., to make a more adhesive spray.

POTASSIUM SULPHIDE.

3 ozs. Potassium Sulphide. 10 gals. Water.

Used chiefly in greenhouses, or for powdery mildews.

5 ozs. Copper Carbonate. 3 pts. Ammonia. 45-50 gals. Water.

Use *just enough* ammonia (if strong, dilute with several volumes of water) to dissolve the copper carbonate; then dilute to final volume. This fungicide is not as good as Bordeaux, but is used to avoid sediment on the foliage or fruit.

COPPER SULPHATE.

2 to 3 lbs. Copper Sulphate. 45-50 gals. Water.

Used chiefly as a winter spray. 1 lb. to 250 gals. water is sometimes though rarely used on foilage.

COPPER LIME-SULPHUR.

2 lbs. Copper Sulphate. 1½ gals. liquid Lime-Sulphur. 45-50 gals. Water.

Dissolve copper sulphate in part of the water, and then add with the lime-sulphur to the remainder. Apparently a good fungicide but likely to russet apples as does strong Bordeaux.

FORMALIN FUMES.

3 pts. Formalin. 23 ozs. Potassium Permanganate.
For each 1000 cu. ft. Space.

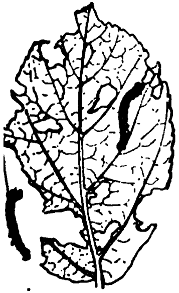
Place bulbs or tubers in 6 to 12 in. crates so fumes can get at them. To prevent injury to potatoes, fill space at rate of 167 bu. Place formalin in large pail in cleared central space and drop in the crystals of potassium permanganate. Close room air-tight for 24 to 48 hours.

INSECT AND FUNGOUS PESTS OF CULTIVATED PLANTS.

APPLE.

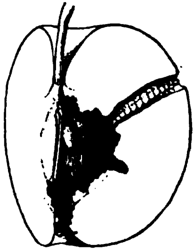
sects, etc.

Bud-Moths: Case Bearers: Leaf Crumpler:—Small overntering caterpillars feed upon the unfolding leaves. Spray with d arsenate as soon as leaf buds begin to open. Repeat a few ys later, if necessary. Rept. 1909, p. 353.



Canker-Worms—During May small looping caterpillars devour the leaves and spin down on threads when disturbed. Spray foliage with lead arsenate before blossoms open, and again soon after they fall. In unsprayed orchards sticky tanglefoot bands should be placed around trunks of trees in October, kept sticky until January 1st, and again kept sticky during April and May. Rept. 1908, p. 777.

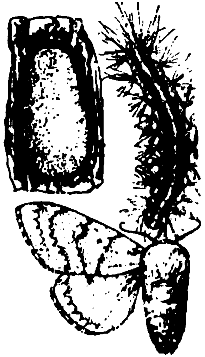
Tent-Caterpillar—During May the caterpillars form nests at the forks of the branches, and devour the leaves. Clip off and burn egg masses on twigs in winter. Remove nests with caterpillar brush. Spray with lead arsenate once before the blossoms open and again soon after they fall. Bull. 177, and Rept. 1913, p. 226.



Lesser Apple Worm Larva feeds on exterior of nearly mature fruit, and often causes injury in storage. Spray twice as for codling-moth. Keep foliage and fruit covered until fruit is nearly grown. Rept. 1910, p. 595.

Codling-Moth or **Apple-Worm**—Pink caterpillar tunnels inside the fruit, especially around the core. Spray with lead arsenate as soon as the blossoms fall. Repeat three and six weeks later. Rept. 1910, p. 594.

Brown-Tail Moth: Fall Web-Worm—See Pear.



Gipsy Moth—Occurs in the United States only in south-eastern New England, New York and New Jersey. Brownish hairy caterpillars defoliate trees in May and June. Band trees with tanglefoot, and with burlap, which should be examined each day to destroy caterpillars. From August to May egg-masses can be destroyed by soaking them with creosote. Spray foliage with lead arsenate. Bull. 186; Repts. 1905, p. 246; 1906, p. 235; 1907, p. 300; also placard.

Curculios· Grubs of both apple and plum curculios infest the fruit, making it gnarled and ill-shaped. Spray twice after blossoms fall as for codling-moth, and remove infested fruit in thinning. Keep fence rows clear of trash. Rept. 1904, p. 210

Green Fruit Worms: Palmer Worm: Leaf Roller—Caterpillars feed upon foliage and immature fruit. Spray with lead arsenate, for codling-moth.

Tussock Moths—Tufted caterpillars of several species feed upon e leaves in mid-summer. Spray with lead arsenate as for dling-moth. Rept. 1905, p. 230; 1907, p. 332; 1916, p. 105; 17, p. 325.

Yellow-necked Caterpillar: Red-humped Caterpillar—Feed in isters and often strip young trees in fall. Hand-picking is easy thod of control. Spray leaves with lead arsenate. Rept. 1901, 274; 1917, pp. 328, 329.

Maggot or **Railroad Worm**—Maggots tunnel through the pulp the ripening fruit of sweet and sub-acid varieties, especially ose ripening early in the season. Destroy all infested fruit. lult flies may be killed by late sprays of lead arsenate. Rept. 10, p. 593.

Round-Headed Borer: Flat-Headed Borer—Grubs burrow in wood at base of trunks. Watch trees and dig out borers wherever sawdust appears. Paint trunk with lead arsenate and lime-sulphur. Rept. 1907, p. 333.

Leaf Hoppers—Whitish insects sucking sap from underside the leaves. Spray with nicotine solution, as for aphis.

Tarnished Plant Bug—Injures developing fruit by sucking sap, forming dimples. Spray with nicotine solution as for aphis.

Red Spider: Clover Mite: European Red Mite—Cause much ıry to leaves, especially in dry seasons. Overwintering eggs ed by winter spray of lime-sulphur.

Leaf-Blister Mite—See Pear.

Green and **Rosy Aphids**—Green aphids suck sap from the leaves and terminal shoots, causing leaves to curl and checking growth. Rosy aphids infest fruit clusters, checking development. Use delayed dormant spray with nicotine solution (½ pint in 50 gallons water), either separately or in combination with lead arsenate, lime-sulphur or Bordeaux mixture. Repts. 1903, p. 259; 1909, p. 343.

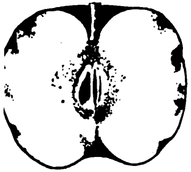
San José Scale—See Peach. Spray dormant trees with lime-sulphur or miscible oil. Bull. 165; Rept. 1904, p. 221.

Red Bugs—Two species of red leaf bugs suck the sap, causing leaves and fruit to become distorted. Spray with nicotine solution, as for aphis throwing the spray against the tree from opposite directions at the same time. Rept. 1917, pls. II-III.

Woolly Apple Aphis—A bluish-white, cottony plant louse in colonies on bark, forming galls or swellings on twigs of small trees, and preventing wounds from healing; also on roots, forming galls, and destroying small feeding roots. Plant only clean or fumigated stock. Soak soil with carbon disulphide, ½ ounce in 4 gals. water. Spray above ground with kerosene emulsion.

Oyster-Shell Scale: Scurfy Scale—Scale insects with elongated or pear-shaped shells, on bark, suck sap from the twigs; the former about the same color s the bark, the latter light gray or whitish. Spray with nicone solution; soap and water; or kerosene emulsion, about the econd week in June. Bull. 143; Rept. 1903, p. 225.

ungi, etc.



Baldwin Spot—Shows as small diseased masses of brownish tissue, usually a short distance beneath the skin; finally may appear at the surface as small, discolored, shrunken areas, then very similar in appearance to some of the fruit speck troubles. Not a fungous, but apparently a physiological disease. hought by some to be due to unusual local loss of water; similar roubles may start from punctures of rosy aphis or other punctur-g insects. No remedy known, except possibly irrigation in the est.

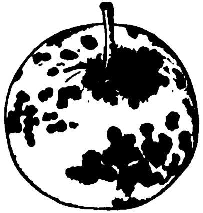
Cankers—Occur on branches and are caused chiefly by European canker fungus which eventually forms a cavity surrounded by concentric elevated rings of wood extending to bark, which each year is killed a little further, adding another ridge. Cut off infected branches, or cut out infected wood and bark; paint over cut surfaces. Keep orchard well sprayed and trimmed. Rept. 1903, p. 299.

Black Rot—Causes mature fruit to rot, eventually urning it black; forms small brown spots on leaves; does some amage through cankers on branches, which are eventually killed. reat as for scab; prune and burn all dead limbs and twigs; cut out nd paint over large cankers when found. Rept. 1909–10, p. 590.

Fruit Specks—Form more or less numerous, small, brown or lack spots, starting at surface of fruit and slowly working inward; he Brooks fruit spot often has a pinkish or purplish border in light-skinned varieties. Usually controlled by spraying as for scab. Late spraying is important. Rept. 1909–10, p. 590.

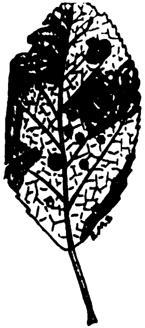
Rust—Shows as orange-colored blotches on leaves, eventually producing minute fringed clustered-cups imbedded on the under side; less frequent on fruit. Rust spreads to the apple from the *cedar-apples*, which appear in the early spring on the red cedar. All cedars near the orchard should be destroyed. There is great difference in the susceptibility of different varieties to this disease. Spraying is only partially successful in this state, as the leaves must be well coated continuously with spray from the time they begin to unfold, until the end of July. Repts. 1891, p. 161; 1909–10, p. 591.

Scab—Produces "scabby spots" on fruit and leaves; rarely on twigs. Spray the unfolding leaves before the blossoms open, again after the petals fall, and follow with a third spraying about four weeks later. For first treatment, use strong Bordeaux, for second and third, weak Bordeaux or lime-sulphur or the latter for all three treatments. Very susceptible varieties sometimes need four treatments, the last two at intervals of about two weeks. Rept. 1909–10, p. 591.

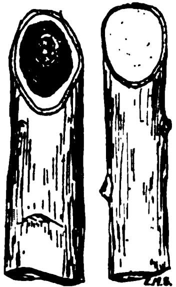


Sooty Blotch—Forms on fruit an olive-black superficial growth in distinct round colonies, or often merging together. Spray with Bordeaux as for scab, or with lime-sulphur 1¼ to 50. The sprayings after blossoming are the more important. Rept. 1909–10, p. 592; 1911, p. 307.

Blight See Pear.



leaves and russeting on fruit. Is most likely to occur after second and later sprayings. Worst in wet seasons. Spraying in bright sunshine may cause some scorch of fruit on sunny side. Varies greatly with different sprays. Avoid those known to be injurious or injurious combinations (as soap and lead arsenate); use Bordeaux only for *first* summer treatment or on varieties not especially subject to russeting. Rept. 1911, p. 360.



Winter Injury—Takes various forms from different conditions, such as imperfect fertilization or russeting of fruit following late spring frosts; sun scorch of trunks due to mild winter weather followed by sudden cold; bud and twig killing, frost cracks in trunks, blackened woods, dead roots, etc., following unusually cold winters or unfavorable environment. Set out only hardy varieties; avoid planting in wet ground or on hillsides with extreme south or southwest slopes. Head trees low; avoid late fertilization and cultivation; keep earth tight around trunks; use cover crops. Rept. 1903, p. 303; 1906, p. 310; 1914, p. 6.

Storage Rots—Are troubles caused by a variety of fungi. Store fruit, in a dry condition, in a cool, well-aired place. Do not store in too deep piles or too tight receptacles. Use poorer keeping varieties first, and sort over if necessary. Apples from well sprayed trees keep best. Rept. 1915, p. 426.

General Treatment for Apple Orchards.

For the general control of fungi and insects on apples in Connecticut we make the following recommendations:

only in the case of the presence of the San José scale, or leaf-blister mite, when commercial lime-sulphur, 1–9, or miscible oils, 1–15, may be used.

(2) As a rule, three summer treatments with a fungicide are necessary to control fungous diseases, and the last two of these should contain an insecticide. These sprayings should be made as follows: 1st, just before the blossoms open, on the young unfolding leaves (April 27th to May 10th, according to the season and variety); 2nd, as soon as all the blossoms have fallen (May 10th to 30th); 3d, about one month later (usually June 10th to 25th).

(3) Where fungi are not prevalent, especially scab, the first summer treatment may be omitted. Occasionally, perhaps in alternative years, where fungi are quite inconspicuous, the fungicide may be entirely omitted, and only the two sprayings with lead arsenate for insects given. With certain fungi and insects a fourth summer spraying is desirable.

(4) For fungicides, we recommend Bordeaux mixture of the 4–4–50 strength for the first spraying, and of the 1–4–50 strength or lime-sulphur for the later sprayings; or lime-sulphur, used at a strength of 1¼ to 1½ gallons per fifty gallons of water, for all three sprayings. The former has better fungicidal value, and the latter is less likely to produce spray injury, especially russeting of the fruit. Where fungi are prevalent, the former might be used, while with varieties russeting badly, as Baldwin, the latter is likely to prove more satisfactory in the second and third summer treatments.

(5) For the insecticide in the above, use lead arsenate, if in the paste form at the rate of three pounds per fifty gallons of the mixture, or if in the powder form one and one-half pounds per fifty gallons.

(6) If canker worms, tent-caterpillar, bud-moth, or brown-tail moth are causing damage, add lead arsenate to the first

summer treatment, and if aphids are present nicotine solution should also be included. Nicotine solution may be added to any of the subsequent treatments to detroy aphids, red bugs, tarnished plant bug, etc.

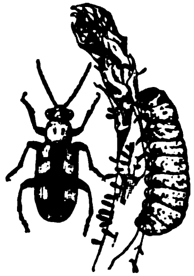
ASH

Insects.

Oyster-Shell Scale—See Apple.

ASPARAGUS.

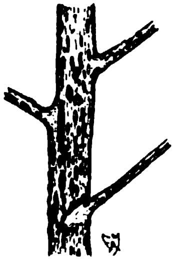
Insects.



Asparagus Beetles, Common and **12-spotted**—Adults and larvae devour the foliage. Cut everything clean during the cutting season; afterward spray with lead arsenate. Repts. 1902, p. 172; and 1903, p. 276.

Asparagus Miner—Larvae tunnel under epidermis of stem near base, causing premature death of plant above ground. Burn infested stalks. Rept. 1906, p. 303.

Fungi.



Rust—Produces (most conspicuous stages) small reddish or black elongated pustules scattered over stems. In fall, carefully gather and burn all stems from affected beds and escaped plants in vicinity. In gathering for market cut below the ground, as protruding stems offer opportunity for development of first stage of the fungus. Spraying with resin Bordeaux partially controls the disease, but this is difficult and expensive. Begin spraying the latter part of July and repeat about every 10 days until the middle of September. Thorough cultivation and fertilization, with plenty of humus in the soil, are advocated as beneficial. Grow varieties most resistant to the disease or select seed for new stock from resistant individuals if found. This disease is not so serious as it was some years ago. Repts. 1896, p. 281; 1904, p. 313.

ASTER.

Insects.

Blister Beetles—Three or four species feed upon the flowers, the black one being commonest. Practice hand-picking and cover choice plants with mosquito netting. Bull. 208, p. 110.

Fungi, etc.

Yellows—Shows in the yellowed and often imperfectly developed foliage and one-sided blossoms. A physiological trouble whose cause is not definitely known. Buy best seed; transplant only healthy plants, and have soil conditions good. Repts. 1903, p. 306; 1914, p. 413 (26).

BARLEY.

Insects.

Army Worm—See Grass.

Fungi.

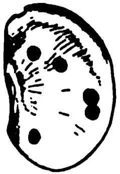
Rusts—See Oats and Wheat.

Smuts—Are of two kinds, covered and loose, both largely destroying the infected spikes and changing them into black, sooty structures, in the latter kind easily dissipated. Treatment, see Oats and Wheat. Rept. 1903, p. 306.

BEAN.

Insects.

Green Clover Worm—Occasionally green, wriggling caterpillars riddle the leaves in June and July. Dust string beans with air-slaked lime or other fine powder. Spray shell beans with lead arsenate. Repts. 1908, p. 828; 1919, p. 165.



Weevils—Adults lay eggs in the pods in the field and continue to breed in the dried seed, finally rendering it unfit for food or for planting. Fumigate the seed with carbon disulphide, store in air slaked lime, or heat in oven for 1 hour between 120° and 150° F. Bull. 195, p. 6.

Fungi.

Anthracnose—Shows on leaves and pods as roundish discolored areas, often with a purplish border. Save seed from pods showing no spots and plant these by themselves, selecting each year seed from unspotted pods for the seed crop and using remainder for general crop. Destroy all infected seedlings. Where very troublesome spray with Bordeaux, beginning when plants are only a few inches high and repeating about every 10 to 14 days until pods are forming. Rotation and destruction of old vines may prove helpful in keeping the trouble in check.

Blight—Appears much like anthracnose, but with discolored areas usually having more of a translucent or watery character. Treat same as anthracnose. Repts. 1898, p. 262; 1903, p. 307.

Downy Mildew—Forms dense, white, woolly growths on pods and less luxuriantly on young stems and leaves of the Lima bean. As the fungus usually appears first and most vigorously in low moist places, the land used should be high or well drained. Serious only in years unusually moist after the middle of July. Spray with Bordeaux beginning about the middle of July, and repeat every 10–14 days until the middle of September. Rept. 1905, p. 278.

Rust—Produces small, round, reddish or black, dusty outbreaks, usually on the leaves. Plant varieties not likely to rust. Burn the old infected plants in the fall. Rept. 1903, p. 308.

BEET-CHARD.

Insects.

Leaf-Miner—A small fly lays eggs in the leaves, and the larvae tunnel or mine between upper and lower surfaces. Practice clean cultivation. Destroy all infested leaves. Destroy all plants of the weed known as "lambs quarters" in which this insect breeds. Practice late fall plowing.

Fungi.

Leaf Blight—See Mangel. Rept. 1903, p. 309.

BEGONIA.

Eelworms.

Leaf-Blight Eelworm — Produces conspicuous dead areas on the leaves of Begonias (especially var. *Cincinnati*), ferns, etc. Spots vary in size and shape according to host and disposition of larger veins.

Buy healthy stock only; keep infected plants by themselves and give them plenty of room; keep leaves as dry as possible and pick off and burn worst infected. Rept. 1915, p. 455.

BIRCH

Insects.

Tussock Moths—See Apple, Hickory, and Horse Chestnut.

Birch Leaf-Skeletonizer or **Birch Bucculatrix**—Small greenish-yellow larvae feed upon both sides of the leaves in late summer, often entirely defoliating the trees. Spray with lead arsenate in July. Rept. 1910, p. 701.

Bronze Birch Borer—Grub makes spiral tunnel just beneath bark of upper main branches, ridges showing on outside. Cut and burn infested trees before May 1st.

BLACKBERRY.

Insects.

Blackberry Crown Borer—Larva tunnels in roots and at base of stem. Dig out and destroy.

Red-Necked Cane Borer—Larva tunnels in canes causing an irregular swelling or gall, often three inches in length. Cut and burn all infested canes in winter or early spring.

Blackberry Sawfly—Larvae devour leaves in June and first part of July. Spray with lead arsenate when young larvae appear. Rept. 1912, p. 236.

Fungi, etc.

Crown Gall—Forms hard galls or irregular excrescences on roots and lower parts of stems of blackberries, raspberries and several other hosts. Dig out and burn affected plants as soon as discovered. Never use infected stock for transplanting. A bacterial trouble. Rept. 1903, p. 354.

Leaf Spot—Forms on leaves small circular spots with whitish center and purplish border; also occurs on dewberry and raspberry. Not usually serious but where necessary it probably can be controlled by Bordeaux applied to the leaves, beginning before they have reached their full size. Rept. 1903, p. 309.

Orange Rust—Breaks out in spring or early summer as dusty masses of bright orange spores over the under side of the leaves. The fungus is perennial in the underground parts of the host, so that the disease appears year after year. Dig up and burn infected plants. Rept. 1903, p. 309.

BOX.

Insects.

Leaf-Miner—A small two-winged fly lays eggs in the leaf and the larvae tunnel between the upper and lower surfaces. Destroy infested leaves.

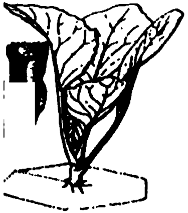
Oyster-Shell Scale—See Apple.

CABBAGE-CAULIFLOWER.

Insects.

Cabbage Worm—Green worms feed upon leaves all through season. Spray unheaded plants with lead arsenate. Use insect powder or hellebore on headed plants. Bull. 190, p. 9; Rept. 1903, p. 271.

Cabbage Looper—Smooth looping caterpillars feed with cabbage worms late in



summer, and require same treatment. Bull. 190, p. 12; Rept. 1910, p. 706.

Cabbage Maggot—Infests stems of early-set plants near surface of ground checking growth and often killing them. Practice crop rotation. Place hexagonal tarred paper disks around stems at setting time. Treat with carbolic acid emulsion. Bull. 190, p. 3; Repts. 1908, p. 832; 1914, p. 142; 1915, p. 114.

Cabbage Aphis—Sucks sap from the leaves. Spray with nicotine solution and soap or with kerosene emulsion. Bull. 190, p. 14.

Fungi, etc.

Black (Bacterial) Rot—Forms black lines in veins of leaves. In time leaves turn yellow and easily drop off, and interior of head develops a general soft rot. As the germs can be carried on the seed, avoid seed from infected fields. If in doubt, treat seed in formalin, 1 part to 240 of water for 15 minutes. Keep refuse from diseased plants out of manure; practice rotation; make seed bed in new soil if disease appears in old one. Rept. 1912, p. 345.

Club Root—Causes knob-like enlargements on the roots of cabbage and allied plants. The germ often becomes established in the soil; when possible avoid such land and the use of refuse from old plants on the soil. Be especially careful that the seed bed is not infected. Infected land, if used, should treated in the fall with lime broadcast at the rate of 80 bushels acre and worked in. Rept. 1903, p. 310.

Soft Rot—See Salsify. Report 1903, p. 311.

CARNATION.

Insects.

Green Fly or **Aphis**—Sucks sap from young leaves and buds. Fumigate greenhouse with tobacco, or spray with nicotine solution and soap, or with soap and water.

Fungi.

Leaf Mold and **Leaf Spot**—Are two troubles much alike in appearance, producing grayish spots with colored borders on stem, leaves and calyx. Treat as for Rust.

Rust—Produces small dusty pustules, more or less confluent, on the leaves and stems. Select, if feasible, only rust-resisting varieties. Spray in field with Bordeaux, adding 1½ lbs. soap to each 50 gallons (helps mixture to adhere to plants). Select for transplanting only hardy and rust-free specimens. Keep air of greenhouse as dry as is consistent with good growth. One or two sprayings with Soap- or Resin-Bordeaux, after transplanting in greenhouse, may be given if desired; for repeated sprayings use potassium sulphide or weak copper sulphate. Rept. 1903, p. 312.

Stem Rot and **Wilt**—Cause the lower leaves first to turn yellow and dry up; then as the stem gradually rots off at its base, the whole plant becomes affected and finally dies. Select cuttings only from perfectly healthy plants, and if necessary start these in sterilized soil and replant out of doors in new land, avoiding excessive use of manure. If disease appears after setting out in the greenhouse, pull up infected plants upon appearance of first symptoms, make liberal application of lime, avoid over-watering, and see that roots are properly aerated. Repts. 1897, p. 175; 1903, p. 312.

CEDAR.

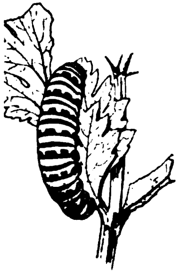
sects.

Web-Worm—Small brown caterpillars feed upon the leaves ich they web together. Spray with lead arsenate.

ngi.

Cedar-Apple Rust—Appears in spring as conspicuous rounded lls with jelly-like horns bearing spores that carry the fungus to ple and related hosts. Cut off and burn all *cedar-apples* if desirable to destroy the trees. See Apple Rust.

CELERY.



Insects.

Celery Caterpillar—Feeds upon the leaves of celery, parsley, fennel, carrot and parsnip. On the latter two plants lead arsenate may be used. On celery and parsley hand picking is perhaps the best remedy.

Fungi.

Leaf Blight and **Leaf Spot** — Are two diseases showing "rusty" spots on leaves and petioles; the latter trouble distinguished by the very minute black dots in the discolored spots (fig.), often progressing in stalks after storage. Spray the plants thoroughly in the seed bed with Bordeaux, as infected plants are often the means of introducing the trouble in the field. If necessary, continue the spraying after transplanting at intervals of about two weeks up to the middle September. Before covering for bleaching, if leaf spot is oundant, dust with sulphur, and before final storage remove incted leaves and dust again. Rept. 1897, p. 167.

Soft (Heart) Rot—Shows as a soft rot of the tissues often confined to the heart. Do not plant in too wet soil, avoid land with green cover crops recently plowed in; in banking allow for proper aeration. See Salsify. Rept. 1914, p. 10.

CHERRY.

Insects.

Cherry or **Pear Slug**—Larvae eat away the green tissue from upper side of leaf. Spray or dust with lead arsenate and sulphur.

Canker Worms—See Apple.

Cherry Maggots or **Fruit Flies**—Larvae of two species infest maturing fruit. Sprinkle foliage with sweetened lead arsenate in early June to kill the adult flies.

Plum Curculio—See Plum..

Cherry Aphid—A brown aphid which sucks sap from under side of leaves causing them to curl. Spray with nicotine solution and soap, soap and water, or kerosene emulsion.

Fungi.

Black Knot—Forms knot-like excrescences, usually several inches long, on twigs and branches. When planting, use only trees free from this trouble; in the orchard, cut off and burn all infected branches in late fall or winter, painting over large cut surfaces. Cutting *out* knots is rarely advisable, as new outbreaks usually result. In cutting off, cut several inches below the knot, to insure removal of the mycelial threads in the tissues. Remove all knots each year until they fail to reappear. Spraying in spring and early summer with self-boiled lime-sulphur or atomic sulphur helps to keep ew knots

the removal of the knots. Rept. 1911, p. 399.

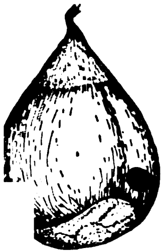
Brown Rot—See Plum. Rept. 1911, p. 402.

Leaf Spot—Shows as numerous, closely placed, purplish spots on aves, which often have "shotholes." Spraying, if begun on oung leaves early in May, is effective but use the dilute Boraux, or better still, self-boiled lime-sulphur or atomic sulphur to void injury to the foliage. Give several sprayings at intervals of vo weeks. This helps to keep down the brown rot also. Repts. 395, p. 188; 1911, p. 401. Also known as anthracnose.

Powdery Mildew—Develops a cobweb-like growth over the aves; in fall forms numerous, minute, black fruiting-bodies, pecially on under surfaces. Usually worst in young trees; ntrolled by spraying if necessary.

CHESTNUT-CHINQUAPIN.

isects.



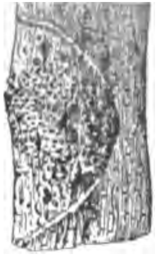
Canker Worms—See Apple.

Nut Weevils—Long-nosed snout beetles lay eggs in developing fruit and the grubs infest the nuts. Destroy all infested nuts. Fumigate nuts with carbon disulphide as for beans.

Two-lined Chestnut Borer—Long, slender, flat-headed larvae make sinuous tunnels under bark of weakened chestnut and oak trees. Badly infested trees should be removed and irned, or the bark removed before the insects mature and spread other trees.

ungi.

Bark Disease (Blight)—Forms cankers in the bark that eventilly girdle infected limb and cause death of parts above. preads over tree so that usually it dies within two to five years.



cutting out and painting over the cankers. For forest trees it is best to let the disease take its course, and remove at least the larger trees within a year or two after their death to prevent deterioration of the wood. Most of the chestnuts in the state have been already killed. Rept. 1912, p. 359; Bull. 178.

CHRYSANTHEMUM.

Insects.

Black Fly or **Aphis**—Sucks the juice from the young leaves and flower stems. Fumigate the house with tobacco; dip the plants in or spray them with soap and water or nicotine solution and soap.

Gall Midge—Larvae form cone-shaped galls on leaves and new shoots. Spray plants about three times each week with nicotine solution and soap. Rept. 1919, p. 161.

Fungi.

Powdery Mildew—Develops a white mealy or cobweb coating on leaves. Use good judgment in airing and watering, and if necessary, spray from time to time with potassium sulphide or paint heating pipes with sulphur.

Rust—Appears as dusty reddish-brown outbreaks, about the size of a pin head, chiefly on under sides of leaves. Avoid worst rusting varieties. Start with cuttings free from rust. Destroy rusted leaves, especially on cuttings. Early sprayings with dilute copper sulphate, potassium sulphide, etc., may help to prevent the trouble from getting a start. Rept. 1903, p. 315.

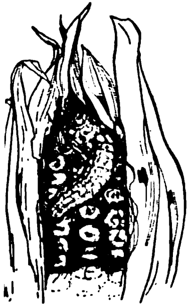
CINERARIA.

nsects.

Aphis or **Green Fly**—Sucks sap from the leaves and stems. Jse nicotine solution and soap, or soap and water, as a spray or dip.

CORN.

Insects.



Cut Worms—See Tomato.

Army Worm—See Grass.

Stalk Borer—See Dahlia.

White Grubs—See Grass.

Corn Ear Worm—Eats the immature kernels at the end of the ear. Dust the silk with equal parts sulphur and powdered lead arsenate. Rept. 1919, p. 188.

European Corn Borer—Imported into eastern Massachusetts, New York and Canada. Larvae tunnel in all parts of plant above ground.)estroy all infested plants. Rept. 1918, p. 316.

'ungi.

Leaf Blight—Kills parts of the leaves in August and September auch like an early frost. Most injurious in wet late seasons. Plant arly maturing varieties and stimulate growth by good fertilization nd cultivation. Rept. 1903, p. 317.

Root and **Ear Rots**—Injures roots and base of stalk with a reddish-brown rot. Stalks are easily broken off and often fail to roduce good ears, the worst infected showing a moldy, white or inkish growth. Plant only vigorous, disease-free seed, practice early rotation and do not let corn follow other grains. Bull. 222, p. 427.

Smut—Forms black dusty outbreaks that appear on various parts of the plant. It is especially injurious to certain varieties of sweet corn. Avoid the use of fresh manure on the land. Seed treatment is ineffective. The removal and destruction of spore masses is recommended by some writers.

CRANBERRY.

Insects.

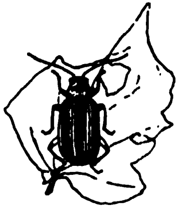
Fireworm or **Black-headed Cranberry Worm**—Small, pale green, black-headed caterpillars web the leaves and new shoots together and feed inside the nest. Spray with lead arsenate to kill the caterpillars. Flood the bog for three days to kill the pupae.

Yellow-headed Cranberry Worm—Small, green yellow-headed caterpillars injure plants in same manner as the preceding. Spray with lead arsenate. Keep bogs flooded until about May 20.

Cranberry Fruit Worm—Pale green larvae infest the berries. Flood the bog for about two weeks as soon as the fruit has been harvested. Destroy all infested berries.

CUCUMBERS.

Insects.

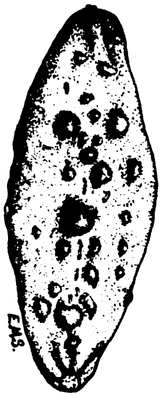


Striped Cucumber Beetle—Attacks young plants, eating the leaves. Larvae infest the main root or stem under ground, often killing the plant. Dust leaves with dry lead arsenate. Cover plants with screens. Bull. 216, p. 34; Rept. 1908, p. 807.

Melon Aphid—See Melon.

less merged, on leaves; occurs occasionally on fruit. Treatment is the same as for mildew. See Watermelon.

Downy Mildew—Forms discolored spots as in preceding, but beneath shows a minute thin growth of upright threads bearing dark colored spores. Repeated sprayings with Bordeaux about every 10 to 14 days during the season, beginning at least by middle of July, usually keeps this disease in check. The same fungus occurs on Melons. Rept. 1904, p. 329.

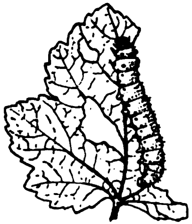


Mosaic and **White Pickle**—Are two very similar, if not identical, physiological diseases, showing in the former on the leaves as mottling of lighter or yellow-green areas scattered among the normally green tissues, and in the latter causing the fruit to become irregularly shaped, knobbed, and often mottled or whitish in color. Keep down sucking insects that may spread the disease, as it is infectious; pull up and destroy vines first showing it. Rept. 1915, p. 430.

Wilt—See Squash.

CURRANT.

Insects.



Currant Fruit Fly—Small maggots infest the berries, which color prematurely and drop. Destroy infested fruit.

Currant Worm—Devours foliage in May. Spray with hellebore or lead arsenate. Rept. 1902, p. 170.

Currant Borers—The larvae of two species

Currant Stem Girdler—Adults cut or girdle tip of new shoots after laying eggs in them. Cut and burn these tips at any time of year. Rept. 1896, p. 238.

Currant Aphids—Yellowish-green aphids on under side of leaves causing them to curl. Underspray with nicotine solution or kerosene emulsion.

Four-Lined Leaf-Bug—A yellow and black striped bug sucking sap from the leaves. Spray with nicotine solution and soap. Bull. 208, p. 118.

San José Scale—See Peach.

Scurfy Scale—A conspicuous pear-shaped light-gray scale on bark, the insect sucking sap from twigs. Spray about second week in June with kerosene emulsion or nicotine solution and soap. Bull. 143; Rept. 1903, p. 227.

Fungi.

Anthracnose and **Leaf Spots**—Cause spots on the leaves and usually their premature shedding; the former also spots the fruit of certain varieties. Spray with Bordeaux as the leaves unfold, and repeat at intervals of 10 to 14 days until fruit begins to turn. If necessary continue spraying after harvest. Rake up and burn leaves in fall.

Blister Rust—Shows first as dusty orange-colored outbreaks about size of pinhead on lower surface of leaves, and later as short hair-like growths. Worst on black currants. Alternate host is white pine. Report presence to the Experiment Station. Rept. 1911-12, p. 347. See Pine.

CYCLAMEN.

Insects.

Leaf-Mite—Transparent microscopic mites cause leaves to curl, and plants do not blossom. Syringe under leaf surface strongly with water. Spray with, or dip plants in nicotine solution and soap, 1 part in 400 parts of water. Avoid excessive moisture in house. Rept. 1914, p. 176.

DAHLIA.

Insects.

Tarnished Plant Bug—Sucks the sap from the stems and buds causing them to fall. Spray with nicotine solution and soap. Rept. 1904, p. 218.

Stalk Borer—Larva tunnels up and down inside the main stem, the top portion usually wilting and dying. Carefully make longitudinal slit in the stem and kill the borer. Bull. 208, p. 111; Rept. 1919, p. 180.

EGG-PLANT.

Insects.

Flea Beetle—See Potato.

Colorado Potato Beetle—See Potato.

Fungi.

Fruit Rots—Caused by several fungi, the gray mold producing the most extensive rot. Spray with Bordeaux; pick off and carry away the rotting fruit.

ELM.

Insects.

Spiny Elm Caterpillar—Clusters of black spiny caterpillars often strip certain branches of elm, willow, and poplar. Remove and destroy entire cluster, or spray with lead arsenate. Rept. 1906, p. 260.

Elm Leaf Beetle—Adult beetles eat holes through the leaves in May, and in June and July the larvae or grubs eat away the green tissues from the under surface. Spray with lead arsenate early in May to kill egg-laying beetles, or spray under surface of leaves with same mixture about June 1st, to kill the larvae. Yellow pupae at base of trees may be killed with kerosene emulsion or soap and water. Bull. 155; Rept. 1908, p. 815.

Canker Worms—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Leopard Moth—Larvae tunnel in branches under the bark, cutting deep galleries, often girdling the branch, which later breaks off and falls to the ground. Small trees may be examined and borers killed by injecting carbon disulphide, or by inserting a wire. Bull. 169; Rept. 1911, p. 317.

Elm Scale—A large brown soft scale, oval in shape with cottony marginal fringe, located especially in the cracks of the bark of trunk and lower branches, sucking the sap. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 235.

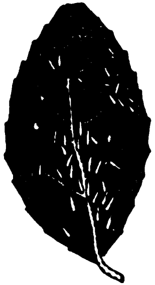
White Elm Scale—A whitish pear-shaped scale on twigs. Spray about June 10th with kerosene emulsion.

Elm Woolly Aphids—Several species curl the leaves, or form in cottony masses on the bark. Spray with kerosene emulsion.

Fungi.

Leaf Spot—Shows as black slightly elevated specks more or less thickly imbedded in the leaves and causing their premature fall. Not usually so injurious as to merit the expense of spraying with Bordeaux, which should start on the immature leaves. Rept. 1909 10, p. 717.

EUONYMUS.



Insects.

Euonymus Scale—The various species of Euonymus are attacked and often injured by this scale, which has narrow white (male) or pear-shaped gray or brown (female) shells. Cut and burn infested twigs. Cover and fumigate with hydrocyanic acid gas. Spray with nicotine solution or kerosene emulsion during June to kill young. Bull. 151; Rept. 1905, p. 240.

FERN.

Insects, etc.

Woolly Bears—Several kinds of light brown hairy caterpillars devour the fronds in late summer. Spray with lead arsenate.

Hemispherical Scale—Brown, oval convex scales on fronds of plants under glass. Apply soap and water or nicotine solution as a dip or spray. Bull. 151, p. 9; Rept. 1905, p. 239.

Leaf-Blight Eelworm—See Begonia.

GERANIUM.

Insects.

Greenhouse Leaf-Tyer—Small green wriggling caterpillars feed upon the leaves of plants under glass. Spray with lead arsenate.

White Fly—See Tomato.

Leaf Mite—See Cyclamen.

Fungi.

Gray Mold Rot—Produces dead spots on leaves and blasts blossoms. Worst in poorly lighted and leaky greenhouses. Keep drippage off plants; avoid watering in cloudy or muggy weather; ventilate. Attacks as a semi-parasite a variety of greenhouse plants. Rept. 1903, p. 322.

GOOSEBERRY.

Insects.

Currant Worm—Devours foliage. Apply hellebore or lead arsenate early in season. Rept. 1902, p. 170.

Gooseberry Fruit-Worm—Feeds inside the berry. Destroy infested berries.

Currant Fruit Fly—See Currant.

Fungi.

Mildew—Forms a felt-like growth on fruit and leaves of young shoots. Worst on European varieties, also attacks currant, especially young shoots. Spray with potassium sulphide or other sulphur spray as soon as buds break, and repeat about every ten days until the end of June.

Blister Rust—Not common as yet on cultivated varieties. See Currant.

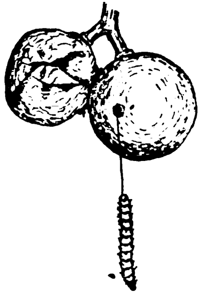
GRAPE.

Insects.

Grape Vine Flea Beetle—Adults and larvae devour the leaves. Spray with lead arsenate the latter part of June.

Rose Chafer—Long-legged brown beetles appear about June 15th and feed upon leaves, flowers and newly set fruit, often doing great damage. Cover choice plants with netting. Spray heavily with lead arsenate just before blossoms open and if necessary again after fruit has set. Rept. 1916, p. 111.

Grape Plume Moth—Small green spiny caterpillars web together the newly formed leaves at the tips of new shoots. Damage more apparent than real. Crushing by pinching these leaves is the best remedy. Rept. 1914, p. 190.

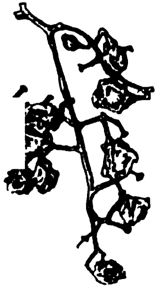


Grape Berry Moth—Larva feeds and develops inside the berries and is the cause of most wormy grapes. Spray with lead arsenate soon after fruit sets, and repeat twice at intervals of about ten days. Bag the clusters soon after the fruit sets.

Grape Root Worm—Adult beetles eat chain-like holes in leaves in July, and larvae or grubs devour the small feeding roots and eat channels in the bark of the larger roots and main stem underground, often causing great injury. Spray leaves with lead arsenate.

Sphinx and **Other Caterpillars**—Several species of horn worms as well as other kinds of caterpillars feed upon the leaves. Spray with lead arsenate or practice hand picking.

Grape Leaf-Hopper—Small, yellow and red-marked leaf-hoppers sucking sap from under side of leaves. Spray under surface with nicotine solution and soap.



Grape Phylloxera—Sucks sap from roots and leaves, forming galls, and causing serious injury to European varieties. Graft on native species.

Fungi.

Black Rot—Causes reddish-brown spots on leaves; more rarely on stems; especially bad in rotting the berries, which finally become hard, shrunken and wrinkled, black mummies. This is one of the worst diseases of the grape and often difficult to control by spraying, which must be thorough, especially the first season. Begin spraying before blossoming time, about the last of May, with second application just after blossoming and subsequent sprayings at intervals of about 10-14 days. Use Bordeaux up to the last of July and then change to Soda Bordeaux or Amm. Sol. Cop. Carbonate, though usually the 4 or 5 sprayings with Bordeaux are sufficient. Repts. 1889, p. 174; 1890, p. 100.

Downy Mildew—Develops usually dense white patches of fruiting threads on under side of leaves and causes more or less discoloration on the upper; also occurs somewhat on stems and fruit. Treat as for black rot. Rept. 1893, p. 77.

Gray Mold—Causes rotting of ripening greenhouse grapes, covering them with a more or less conspicuous grayish mat of fruiting threads. Remove rotting grapes from the house. Use care in ventilating and watering. If necessary spray bunches several times with potassium sulphide.

Powdery Mildew—Produces a cobweb-like growth over upper surface of leaves; most conspicuous in the fall, when the minute, round, yellowish to black fruiting-bodies are found scattered over surface. Treat as for black rot. Potassium sulphide is also used effectively against this fungus. Repts. 1895, p. 185.

GRASS.

Insects.

White Grubs—White grubs are the larvae of June beetles, and when abundant in the soil and approaching maturity, cause much damage, especially in seasons following drought, by eating off the roots of grass, corn, strawberries, etc. Plow just before October 1st to expose insects. Harrow very thoroughly before planting. Repts. 1912, p. 288; 1915, p. 179.

Fall Army Worm—Attack similar to that of army worm but occurs in September instead of July, and is more apt to be con-

great numbers from one field to another. Same remedies apply. Also practice late fall plowing. Rept. 1912, p. 284.

Army Worm—In certain seasons grasses and grains are stripped of leaves and heads during July by brown striped caterpillars, which when abundant move like armies from one field to another often causing great damage. Spray with lead arsenate, strips of grass or grain to protect fields not attacked. Plow deep furrows across line of march, turning the furrow towards the line. Sprinkle migrating worms with kerosene. Use poisoned bran mash. Rept. 1914, p. 157.

HICKORY.

Insects.

Fall Web-Worm—See Pear.

Walnut Caterpillar—See Walnut.

Hickory Tussock Moth—White and black hairy caterpillars feed upon the leaves in late summer. Spray with lead arsenate. Repts. 1907, p. 332; 1917, p. 325.

Hickory Bark-Beetle—Small black beetles breed under bark and the galleries soon girdle the tree. Adults emerge, leaving numerous round holes as if the bark had received a charge of bird shot. Beetles also feed at base of compound leaf stems causing them to break and fall in midsummer. Has killed thousands of trees in Atlantic States. Badly infested trees should be removed before May 1st, and burned or at least the bark removed. Spray healthy and slightly infested trees about June 1st, with strong lead arsenate and nicotine solution. Repts. 1901, p. 267; 1914, p. 198.

Hunt for sawdust, find the burrow, inject carbon disulphide, and plug the entrance.

Nut Weevils—Larvae infest the fruit or nuts. See Chestnut.

Hickory Gall Aphid—Curious galls on the leaf stems often cause the leaves to fall in midsummer. Galls contain large numbers of aphids. Spray with nicotine solution just as new growth starts in spring. Rept. 1916, p. 145.

HOLLYHOCK.

Fungi.

Rust—Appears as small, compact, reddish-brown outbreaks on both leaves and stems. After their death in fall, cut off the plants close to the ground, carefully gather up these and any rubbish that may contain spores, and destroy them. Spraying with Bordeaux is recommended by some as helpful in checking the rust; begin as plants push through ground. Rept. 1895, p. 188.

HOP.

Insects.

Hop-Vine Borer—Larva tunnels in tip, checking growth, and later in the stem above and below the surface of the ground. Crush larvae in the tips, remove soil from the base, and after leaving the main roots exposed for a week, apply wood ashes or ammoniated phosphate and hill up. The plants will make new roots.

Hop-Vine Snout Moth—Green, white-striped larvae feed upon the leaves in June. Spray with lead arsenate while the larvae are small.

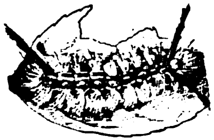
Hop-Merchants—Brown, spiny caterpillars of two species of tortoise-shell butterflies feed upon the leaves. Spray with lead arsenate.

Hop Aphid—Green aphids suck the sap from the under leaf surface. Spray with kerosene emulsion.

Fungi.

Powdery Mildew—Coats leaves and stems with whitish powdery growth, the mature fruiting bodies finally showing as loosely imbedded blackish specks. Found here so far only on ornamental varieties. Make several sprayings with commercial lime-sulphur. Rept. 1911-12, p. 349.

HORSE CHESTNUT.



Insects.

White-Marked Tussock Moth—Tufted caterpillars devour leaves in midsummer. Spray with lead arsenate. Repts. 1905, p. 230; 1916, p. 105.

Fungi.

Leaf Spot—Forms extended reddish-brown areas on the leaves, frequently resembling sun scorch, but showing the fruiting stage as minute black dots in the dead tissues. This trouble can no doubt be controlled by spraying with Bordeaux. The first application is made on the unfolding leaves and is followed by one or two subsequently at intervals of about 2 weeks.

HORSE RADISH.

Insects.

Flea Beetle—Adults feed on the leaves, and larvae tunnel in the petioles. Spray with Bordeaux mixture and lead arsenate.

IRIS.

Insects.

Iris Root Borer Larva tunnels in the rootstocks injuring many plants. Destroy infested rootstocks. In bad infestations burn over the beds in winter to destroy the eggs. Repts. 1915, p. 189; 1918, p. 331.

Fungi, etc.

Leaf Blight—Forms elliptical spots with purplish border; if abundant causes leaves to turn yellow and die prematurely; worst on German Iris. Keep foliage coated with Bordeaux or lime-sulphur, beginning early; gather and burn infected rubbish in late fall.

Soft Rot—Attacks rootstocks destroying lower parts so that leaves turn yellow and die. Same bacterial disease described under Salsify. Propagate only from healthy stock; plant in well drained soil; use only well rotted manure; prevent winter injury of roots. Rept. 1903, p. 327.

IVY, BOSTON.

Fungi.

Leaf Spot—Forms conspicuous brownish spots with purplish borders, which run together if abundant. Leaf stage of black rot of grape. Give several sprayings with commercial lime-sulphur, beginning on unfolding leaves. Burn leaves in fall.

KALE.

Insects.

Turnip Aphid—See Turnip.

Fungi.

Black Rot—Rept. 1915, p. 431. See Cabbage.

LARCH.

Insects.

Larch Sawfly—Larvae defoliate trees in midsummer. Spray with lead arsenate. Rept. 1915, p. 125.

Woolly Aphid—White cottony tufts on the bark and at the leaf whorls. Spray with kerosene emulsion.

LETTUCE.

Insects.

Aphid or **Green-Fly**—Sucks sap from leaves. Fumigate with tobacco or hydrocyanic acid gas. Spray with soap and water.

Fungi.

Drop—Causes sudden wilting of plants by infecting and rotting off leaves at surface of soil; often shows a white moldy growth over the basal parts. This may develop into a serious trouble in the greenhouse, as the fungus often becomes established in the soil, when the best remedy is to change the soil entirely or sterilize it by steam or formalin (formula D). Treat some days before using. Parsley is also subject to this disease in the greenhouse. Rept. 1908, p. 863.

Leaf Mold and **Mildew**—The first produces a brownish and the second a white moldy growth in spots on the leaves. These diseases are held in check by sub-irrigation or care in watering and ventilating to keep plants and atmosphere as free from moisture as is consistent with good growth.

LILAC.

Insects.

Lilac Borer—A white larva tunnels in the twigs. Cut and burn infested twigs. Rept. 1905, p. 260.

Oyster-Shell Scale—See Apple.

San José Scale—See Peach.

Fungi.

Powdery Mildew—Forms whitish cobwebby coating on leaves, with mature stage finally abundant as black dots. Conspicuous and common, but hardly demands preventive treatment.

LILY.

Insects.

Aphid—Yellow plant lice with red markings, on under side of leaves. Spray with nicotine solution and soap.

Stalk Borer—See Dahlia.

LINDEN.

Insects.

Canker Worm—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Linden Borer—A white larva tunnels in wood at base of trunk. Dig out borer, or inject carbon disulphide. Rept. 1915, p. 186.

LOCUST.

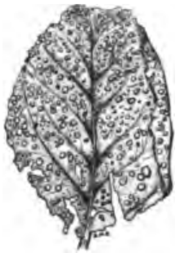
Insects.

Locust Borer—Larvae tunnel in solid wood of trunk. When new leaves appear, spray bark of trunk and larger branches with mixture made by dissolving ¼ lb. sodium arsenite in 5 gallons water to which 1 quart of miscible oil is added and the whole thoroughly agitated.

MANGEL.

Insects.

Leaf Miner—See Beet.



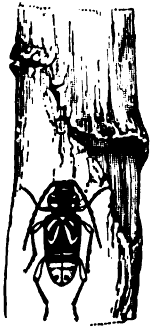
Fungi.

Leaf Blight—Shows as grayish circular spots with purplish borders; when abundant causes premature death of leaves. Rotate; keep refuse out of manure piles; if necessary spray with Bordeaux before disease gets started. Rept. 1915, p. 432.

Root Rot—Rots off roots below ground, turning foliage yellow and often killing it. Not common, but injurious occasionally in low wet fields. Avoid wet ground; keep rotted plants out of manure. Rept. 1915, p. 433.

Insects.

MAPLE.



Maple Borer—Larva tunnels in spiral course upward around trunk or larger branches of sugar maple working in sapwood and cambium, often girdling the trees. Examine trees in September for sawdust. Find the burrow, inject carbon disulphide and plug the opening. Rept. 1907, p. 336.

White-marked Tussock Moth—See Horse Chestnut.

Other Tussock Moths—See Apple.

Canker Worms—See Apple.

Woolly Maple Leaf Scale—Cottony or woolly masses of wax, containing the females, eggs and sometimes larvae, appear on the under side of the leaves in midsummer; insects suck out the sap causing leaves to fall prematurely. Males and larvae enter crevices of bark of trunk and branches; larvae make cases here and pass the winter. Attacks only sugar maples. Spray dormant trees with nicotine solution and soap. Burn all infested leaves. Bull. 151; Repts. 1905, p. 226; 1911, p. 345.

Cottony Maple Scale—Large, oval, brown soft scales on bark of branches of silver and red maples. Each scale in early summer develops a large cotton-like tuft of wax, nearly half an inch long, and soon after the young appear. Spray with miscible oils. Bull. 151; Repts. 1905, p. 237; 1913, p. 252.

Terrapin Scale—Small reddish-brown soft scales on small twigs of silver and red maples, sometimes killing the branches. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 238.

Oyster-Shell Scale—See Apple.

Maple Aphids—Green aphids are common on under surface of leaves of Norway and Sycamore maples in June. Spray with nicotine solution and soap, or with kerosene emulsion.

Gall Mites—Disfigure leaves by forming galls on upper surface. Destroy infested leaves.

Fungi, etc.

Anthracnose—Causes more or less extended dead areas in the leaves, often hard to distinguish from the leaf scorch. Its appearance depends on character of season and is difficult to foretell, but only occasionally serious. For this reason spraying is of doubtful value in the long run, but when made should start on the unfolding leaves. Repts. 1903, p. 329; 1915, p. 436, unusual form.

Black (Tar) Spot—Forms slightly thickened black spots on the leaves, resembling finger prints. Cut-leaf maples are especially susceptible. Rake up and burn all leaves in the fall. Rept. 1908, p. 852.

Leaf Scorch—Causes more or less extended and irregular dead areas to appear suddenly, usually from the leaf margins inward. A physiological trouble due to sudden or excessive evaporation beyond the supply of water furnished by the roots, which is in turn due to abrupt changes in atmospheric conditions, drought, injury to roots, etc. Pruning, when necessary, watering or mulching, and stimulating root growth by nitrogenous fertilizers are probably best remedial measures. Rept. 1905, p. 267.

Stag-head—Kills trees at the top or large central branches gradually die. Due to various agents or unfavorable environment such ing gas in soil, winter injury, etc. Cut off dead and dying branches, clean out decaying wood, treat with a wood preservative and if necessary fill cavities. Stimulate new growth by nitrogenous fertilizers.

MARGUERITE.

Insects.

Marguerite Fly or **Leaf Miner**—A maggot tunnels between upper and lower leaf surfaces. Spray every ten or twelve days with nicotine solution. Rept. 1915, p. 188.

MELON (MUSK).

Insects.

Melon Aphid—Sucks the sap from the under side of the leaves, and when abundant causes much damage. Underspray the leaves with nicotine solution and soap. Bull. 216, p. 47; Rept. 1908, p. 813.

Striped Cucumber Beetle—See Cucumber.

Fungi.

Anthracnose—Appears occasionally. See Cucumber and Watermelon.

Downy Mildew—Forms angular, eventually brown spots in the leaves, often stunting or killing vines; most prominent just before melons ripen, later ones often not maturing or worthless because lacking flavor. It is questionable whether this trouble can be controlled effectively and profitably by sprayng during a very moist season. During dry or semi-moist seasons, however, results are satisfactory, so we recommend spraying as one of the regular operations of melon growing. It should be started soon after the vines begin to run, at least by the middle of July, and the vines should be kept covered with the Bordeaux to the end of the season. Rept. 1904, p. 329.

to those caused by downy mildew. Spray with Bordeaux on the first running vines and repeat every 10 to 14 days, making 4 or 5 applications according to season. Repts. 1895, p. 186; 1898, p. 225.

Wilt—See Squash.

MILLET.

Insects.

Fall Army Worm—See Grass.

NASTURTIUM.

Insects.

Aphid—Brown aphids cluster on stems and leaves sucking the sap. Spray with nicotine solution and soap.

OAK.

Insects.

Canker Worms—See Apple.

Brown-Tail Moth—See Pear.

Orange-striped Oak-Worm—Black and orange striped caterpillars feed upon the leaves late in summer. Spray with lead arsenate.

Fungi.

White Heart Rot—Forms on trunks shelf-fungi, often somewhat hoof-shaped, eventually with dark, creased and cracked, upper surface and rusty-brown, porous, fruiting, lower surface. Gains entrance through wounded and dead branches; causes white rot of heart wood and slow death of sapwood and bark. Break off and burn fruiting bodies; if feasible cut out diseased bark and sapwood, and dig out dead heartwood and fill cavity with cement. Occurs in other deciduous trees. Bull. 222, p. 446.

OATS.

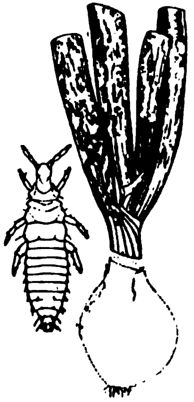
Insects.

Army Worm—See Grass.

ungi.

Black Stem Rust—Forms, chiefly on leaf sheaths and stems, first the II stage as reddish pustules and later the III stage as elongated black outbreaks. Also occurs on wheat, rye, and other grasses as different strains. The I stage appears in spring on barberry leaves as cluster-cups but the fungus can skip this stage. Quite serious in regions where grain is grown extensively, and difficult to control. This and several related species are becoming more important here as more grain of various kinds is grown. Cut out barberries in vicinity of fields.

Smut—Destroys the grain, turning it into a black dusty mass f spores. Seed treatment will prevent this smut. Either soak he seed 8 to 10 minutes in water at 132–5° F., or sprinkle thorughly with formalin (formula A), stirring the grain so that it is thoroughly wet, and leave in piles for several hours before drying out. A less cumbersome treatment coming into general use is that given under formula B. Buy seed from smut-free fields.



ONION.

Insects.

Thrips or "**White Blast**"—Very small insects which feed upon the surface of the leaves, giving the field a whitish appearance. Burn all tops and refuse; burn over the grass land around the field to kill over-wintering insects. Spray with nicotine solution and soap, or kerosene emulsion. Repts. 1903, p. 266; 1913, p. 233.

Maggot—Infests the bulb of the young plant. Practice rotation of crops. Spray plants here and there over the field with sweetened lead arsenate to kill the adult flies. Rept. 1911, p. 286.

Fungi, etc.

Anthracnose (**Black Spot**)—Produces black circular spots on the bulbs, usually on white varieties after storing in the barn. Store onions as dry as possible and keep barn dry and cool. Avoid piling too deeply in bins. Possibly air-slaked lime mixed with sulphur scattered over them at time of storing may prove beneficial. See Stem Rot for treatment with formalin fumes. Fig. (A). Rept. 1889, p. 163.

Smut—Forms black dusty outbreaks on various parts of plants raised from seed; especially injurious to the very young seedlings. This fungus becomes established in the soil, hence infected land should be avoided or used only for transplanted onions. If, however, it is seeded, apply with the seed in drills per acre, 100 lbs. sulphur thoroughly mixed with 50 lbs. air-slaked lime. Formalin (1 lb. or 1 pt. to 12 or 15 gallons water) thoroughly sprinkled over the seed, before covered, by drip attachment to the seeder, is an even more desirable remedy. Repts. 1889, p. 129; 1895, p. 176.

Stem Rot—Causes rotting of bulbs at stem end, where they become soft and shrunken, sometimes showing beneath the layers a dense olive-brown growth of mold. This fungus in a moist season occurs on various parts of the plant in oes not usually appear as a serious trouble with the bulbs ntil some time after they have been placed in the barn. Treat s for black spot. Late field spraying with Bordeaux shortly efore pulling and again while lying in the field, combined vith treatment by formalin fumes (See Fungicides) after storing, as given some indications of benefit. See Fig. (B) under nthracnose. Repts. 1903, p. 334; 1904, p. 321.

PALMS.

nsects.

Scales—Several kinds of white and brown scales infest the pecies of palms grown in greenhouses. Apply nicotine solution r soap and water as a spray or as a dip.

ungi.

Anthracnose—Frequently causes leaves to die at tip. Fungus nconspicuous, may show as small black imbedded specks oozing inkish masses of spores. Avoid infected stock or isolate it; ick off and burn worst infected leaves; keep leaves dry and house vell ventilated. Rept. 1913, p. 18.

PARSLEY-PARSNIP.

nsects.

Celery Caterpillar—On both hosts. See Celery.

Parsley Stalk Weevil—Larva tunnels in crown of plant. No emedy other than to destroy infested plants. Rept. 1913, p. 252.

ungi.

Drop—On Parsley. See Lettuce.

Soft Rot—On Parsnip. See Salsify.

PEA.

nsects.

Green Pea Aphid—Attacks the plants early in June and sucks he sap from the leaves and stems, often causing great injury.

vines with nicotine solution and soap. Brush the vines just before cultivating. Repts. 1899, p. 240; 1913, p. 235.

Pea Weevil—The adult lays eggs in the pods in the field and the larvae develop in the seed, emerging through round holes. Fumigate with carbon disulphide. Bull. 195, p. 5.

Fungi.

Leaf Spot and **Powdery Mildew**—The former shows as roundish spots on both pods and leaves; the latter, as a mealy or cobweb-like coating on same. Neither seems to be sufficiently injurious here to warrant the expense of spraying.

Root-Rot—Kills tops of roots and base of vines, causing parts above to turn yellow, wilt and die prematurely. Caused by various soil fungi of which the downy mildew was especially prominent in 1919. Practice rotation, use *well-rotted* manure and give frequent cultivation in wet years to hasten the drying of the top soil. Bull. 222, p. 450.

PEACH.

Insects.

Peach Saw-Fly—Larvae feed upon leaves in June and July. Spray with lead arsenate. Rept. 1907, p. 285.

Peach Borer—Larva tunnels in the base of the trunk. Dig out in late fall and early spring. Paint base of trunk with lead arsenate and lime-sulphur. Remove top soil and sprinkle powdered paradichlorobenzene around the trunk, using about 1 ounce per tree and cover with soil. Rept. 1909, p. 359.

Fruit Bark-Beetle or **Shot-Hole Borer**—Makes minute tunnels under the bark of branches and trunk. Burn infested trees and keep others thrifty. Rept. 1896, p. 240.

Plum Curculio—See Plum.

San José Scale—Minute scale insects, with circular shell, which suck the sap from twigs, fruit and leaves. On fruit a red spot surrounds each insect. Spray dormant trees with lime-sulphur. Bull. 165; Rept. 1901, p. 240.

Black and **Green Aphids**—Suck the sap from the leaves and shoots. Spray with nicotine solution.

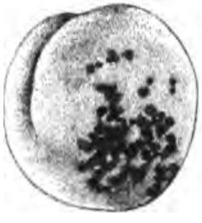
Fungi, etc.

Brown Rot—Occurs on the young twigs, etc., but causes most serious injury to the fruit, rotting it about the time of its maturity. The rotten areas usually become covered with numerous pustules of dusty brownish spores; eventually the diseased fruits form hard mummies. These carry the fungus over the winter, and if half buried in the soil develop in early spring the mature stage, which causes infection of the blossoms, etc. Certain early varieties, like the Champion, are especially subject to rot. Spraying these apparently pays in this state. See general directions for treatment. This fungus occurs on plums and cherries and less commonly on pears and apples. Repts. 1909-10, pp. 607, 612; 1911, pp. 374, 391.

Crown Gall—See Plum.

Leaf Curl—Causes young leaves to become irregularly curled and swollen and finally to drop off; rarely on fruit. In April as soon as buds begin to swell, spray the trees thoroughly with commercial lime-sulphur 1-9. If more convenient this may be done in late fall and is claimed to be just as effective. Same treatment takes care of San José scale. Repts. 1909-10, pp. 608, 612; 1911, p. 374; 1914, p. 19.

Powdery Mildew—Forms a grayish felt on young twigs and leaves. Prune off infected twigs. Give winter treatment as for leaf curl, and, if necessary, summer treatment as for scab and brown rot.



Scab—Produces roundish, olive-black spots on the fruit, discolored areas on the young twigs, and rarely "shot-holes" in the foliage. Two treatments with self-boiled lime-sulphur or atomic sulphur upon the fruit after setting and when half grown (about the middle of May and June) will control this trouble. Repts. 1896, p. 269; 1909-10, pp. 608, 614; 1911, pp. 375, 391.

Spray Injury—Is more likely to occur than with same treatment on apple, *q. v.* Avoid Bordeaux altogether. See (3) under general treatment following. Repts. 1900, p. 219; 1911, p. 372.

Winter Injury—Shows in various ways. In severe winters, especially when the ground is bare, the roots may be killed without injury to parts above the ground. In spring such trees put forth a scanty sickly foliage that soon drops. Often the injury occurs in the form of a "collar girdle" in the bark at the base of the tree. Sometimes it occurs above ground in the wood (shown by its blacker color), with or without injury to the bark. When the bark is not injured, severe pruning in spring will often save the trees. Nursery trees can sometimes be cut back to the snow line, below the injury, and an entirely new healthy trunk started. Avoid late applications of nitrogenous fertilizers and cultivation after middle of July. Mulch base of young trees in late fall with earth. Secure good drainage. See Apple. Repts. 1903, p. 341; 1908, p. 872.

Yellows—Causes premature ripening and red spotting of fruit with yellowish curled leaves, and in time spindling sprout growths in bunches on the trunk. This is claimed to be a contagious disease, but it is apparently physiological in nature. Little peach in this state is scarcely to be distinguished from yellows, showing chiefly in the small backward fruit. Root out and burn all trees as soon as found; prevent winter injury; be careful in selecting stock for planting. Nurserymen should use especial care in selecting their stock for budding. Repts. 1893, p. 92; 1908, p. 872.

General Treatment for Peach Orchards.

(1) Spraying of peaches while dormant is of value only in checking San José scale, mites and leaf curl. One application of commercial lime-sulphur, 1-9, either in late fall or early spring, will take care of all of these troubles at the same time. If the scale and the leaf curl are unusually prevalent, both applications will prove of value in controlling them.

(2) For the prevention of scab and rot of peaches, it is as a rule desirable to give three sprayings, as follows: 1st, shortly after the blossoms have fallen (May 15th to May 25th); 2nd, about three or four weeks later (June 5th to June 15th); and 3d, about one month later (July 5th to July 15th). If only two sprayings can be given, omit the first if spraying only for rot, and the last if spraying only for scab.

(3) On the whole, self-boiled lime-sulphur of the 8-8-50 formula or atomic sulphur seem to be the safest and most reliable peach sprays. Fair results have been obtained with some of the cial lime-sulphurs, and they are much more easily handled. There is, however, some danger of spray injury, especially with certain brands. If commercial lime-sulphur is used, a strength of not greater than 1-150, without poison, is recommended.

(4) As lead arsenate has done little to prevent curculio injury, and as it seems to increase the danger of spray injury, we advise leaving it out unless there is considerable danger from the sawfly, when it can be added in the second spraying the same as for apples.

PEAR.

Insects, etc.

Pear or **Cherry Slug**—See Cherry.

Codling-Moth—See Apple.

Brown-Tail Moth—Occurs in the United States only in eastern New England. Brown hairy caterpillars feed on leaves, and make winter nests on twigs, maturing about the middle of June. Cut and burn winter nests. Spray foliage as soon as blossoms fall, and also in August, with lead arsenate. Rept. 1910, p. 683; Bull. 182.

Fall Web-Worm—Makes nests on ends of branches of many kinds of trees in late summer, the brown, hairy caterpillars feeding inside the nests. Clip off and burn nests when small. Spray with lead arsenate. Repts. 1901, p. 270; 1917, p. 319.

San José Scale—See Peach.

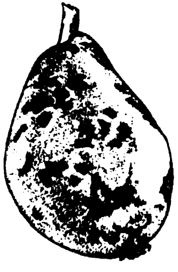
Pear Psylla—Small jumping plant lice suck sap from leaves and twigs, causing leaves to fall in midsummer. Spray with lime-sulphur in spring just before buds open. Spray infested trees with nicotine solution and soap in July. Rept. 1903, p. 262.

Pear Thrips—A minute insect which feeds upon the unopened fruit buds destroying them so that fruit does not set. Spray with nicotine solution and soap just as buds open, and again after blossoms fall.

False Tarnished Plant Bug—Punctures developing fruit causing it to be irregular and knotty. Spray with nicotine solution and soap.

Leaf Blister Mite—Attacks unfolding leaves of apple and pear; forms galls or blisters which become red and later brown. Causes many leaves to fall in July. Spray dormant trees with lime-sulphur in late fall or in spring. Rept. 1910, p. 700.

Fungi, etc.



Scab—Forms olive-black scabby spots on fruit and leaves, often causing the former to become distorted and cracked. The fungus lives over winter on the twigs. Certain varieties are not much injured, others, like Flemish Beauty, are very susceptible. Spray with Bordeaux on unfolding leaves before blossoms open, again after petals fall, and give the third spraying about two weeks later, using weak Bordeaux in last two treatments. Repts. 1894, p. 135; 1904, p. 323; 1911, p. 396.

Blight—Kills young twigs, the leaves suddenly turning black; also produces sunken dead areas on trunks. This is a bacterial disease chiefly spread by bees during blossoming time, or by sucking insects. Winter-prune all diseased branches, cutting off several inches below the diseased area. Cut out cankered areas and swab with disinfectant, paint exposed wood when dry. Several times after blossoming remove all young dead twigs. Use knife sterilized from time to time by wiping with a cloth saturated with carbolic acid or with corrosive sublimate (1-1000). This disease occurs also on apple and quince. Rept. 1894, p. 113.

Leaf Blight—See Quince.

PEONY.

Insects.

Rose Chafer—Adult beetles feed upon blossoms of white varieties. See Grape.

PHLOX.

Insects.

Red Spider—Injures leaves causing them to turn yellow. Clean culture. Spray clear water with force from hose, and in severe infestations, with kerosene emulsion, or with nicotine solution and soap.

Fungi.

Powdery Mildew—Covers more or less completely leaves and young stems with grayish coating within which are finally imbedded numerous, small, blackish fruiting-bodies. Give several sprayings with commercial lime-sulphur, starting before mildew gains much headway.

PINE.

Insects.

Sawflies—Larvae of several native and imported species feed upon the leaves. Spray with lead arsenate. Rept. 1917, p. 273.

White Pine Weevil—Adult snout beetle lays eggs on leader in May and grubs feed and develop in it, causing it to wilt and die in midsummer. Leaders of ornamental trees may be protected by spraying them with lead arsenate or lime-sulphur. Jarring the adults into a net once a week during month of May, serves to greatly reduce the damage. Infested leaders should be cut and destroyed. Repts. 1911, p. 307; 1919, p. 144.

Pine Leaf Scale—Whitish pear-shaped shells on leaves; small trees sometimes killed. Spray with nicotine solution or kerosene

p. 240.

Pine Bark Aphid—White cottony or woolly objects on bark and sometimes on leaves, sucking out the sap. Spray with kerosene emulsion. Repts. 1911, p. 343; 1919, p. 155.

Fungi, etc.

Blight (so-called)—Stunts the leaves and kills their tips inward, often suddenly, so that the tissues for a greater or less distance are reddish-brown. This is a physiological disease; not contagious; due to adverse weather conditions. Chief among these are severe winters, killing the leaves directly or indirectly through injury to roots; warm days, in late winter or early spring when ground is frozen, causing transpiration of water from the leaves that cannot be replaced; very late spring frosts, killing tips of new leaves; sudden changes, in summer from moist or muggy weather to bright sunshine resulting in excessive transpiration and injury; very dry summers. No effective remedy. Rept. 1907, p. 353.

Dampening Off—Caused here chiefly by Rhizoctonia fungus rotting base of the stem, the seedling falling over. Sometimes it creeps up the stem invading the base of the leaves which wither. Certain conifers are more subject to attack then others. Avoid unnecessary watering; provide good ventilation; infected soil often can be helped by treatment with formalin before seeding (see Fungicides, formalin D); spraying with Bordeaux is effective in some cases. Repts. 1912, p. 348; 1915, p. 450.

Stem Rusts—Form on the swollen stems temporary, but conspicuous, white, blisterlike spore cups filled with a dusty orange-colored spore mass. The white pine blister rust, an imported species, spreads to the gooseberries and currants, and forms other less conspicuous leaf stages on these (*q. v.*). A very similar native species on two and three needle pines spreads to the leaves of the sweet fern. In either case infected pines should be destroyed,

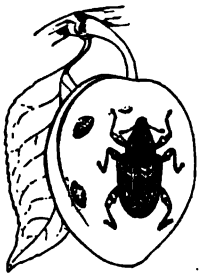
occur in the neighborhood. Seed beds should never be made in the vicinity of the alternate hosts, as infection takes place easily in the young pine seedlings. Spray beds with Bordeaux if liable to infection. In white pine plantations pull out all currants and gooseberries including those in the immediate neighborhood (500 feet). Send any suspicious white pines or their alternate hosts to this Station for examination. Rept. 1912, p. 347; Bull. 214, p. 428.

PLUM.

Insects.

Plum Aphids—Suck sap from leaves. Spray with kerosene emulsion, nicotine solution and soap, or with soap and water.

San José Scale—See Peach.



Plum Curculio—Grub infests the growing fruit, causing it to fall. Jar the trees each morning for six weeks after blooming and catch the beetles on sheets and destroy them. Spraying with lead arsenate during the same period is also advised. Rept. 1910, p. 609.

Fruit Bark-Beetle or **Shot-Hole Borer**—See Peach.

Fungi.

Black Knot—See Cherry.

Brown Rot—Thin fruit so it does not touch. Gather and destroy all mummies after harvest. Rather difficult to control by spraying, as spray does not readily adhere to the smooth fruit. First treatment with self-boiled lime-sulphur, should be made on half grown fruit, others at intervals of two weeks, and the last one 10-14 days before picking. See Peach.

Crown Gall—Forms hard roundish knots one-half inch or more in diameter, near crown or on roots, less frequently on lower part of trunk. Do not plant infected trees. Remove knots when found and paint over cut surface. This is said to be very troublesome in some states, but here, as yet, little damage has resulted from it except possibly on blackberries and imported roses. It also occurs on peach, apple, raspberry, and various ornamental plants.

POPLAR.

Insects.

Poplar Tent-maker—Larvae feed on leaves and fold them together near ends of branches, forming nests. Spray with lead arsenate. Rept. 1911, p. 310.

Spiny Elm Caterpillar—See Elm.

Tussock Moths—See Apple, Hickory and Horse Chestnut.

Poplar Borer—Larvae make large galleries in wood of trunk. Dig out, or inject carbon disulphide into the burrow and close the opening. Rept. 1907, p. 336.

Poplar and **Willow Curculio**—Larva tunnels in smaller trunk and branches. Destroy badly infested trees. Cut out borers; inject carbon disulphide. Rept. 1907, p. 335.

Oyster-Shell Scale—See Apple.

Fungi.

European Canker—Forms sunken dead areas of varying extent in the bark. Importation from Europe; showing here most commonly on Lombardy and white poplars. If trees are badly injured cut down and burn; otherwise cut out diseased areas going into the healthy bark, scraping and painting over exposed wood if surface is extended. Bull. 222, p. 461.

Rusts—Show on leaves as minute, powdery, yellow-orange pustules in II stage, and as slightly elevated reddish blisters in III stage. Have I stage, for different species, on larch and hemlock. Avoid planting near these hosts in nursery; rake up and burn infected leaves in the fall. Rept. 1915, p. 440.

POPPY.

Insects.

Aphids—Black aphids suck sap from stems and leaves. Spray with nicotine solution and soap.

POTATO.

Insects.

Flea Beetle—Small black jumping beetles eat holes through the leaves. Spray heavily both upper and under leaf surfaces with lead arsenate or calcium arsenate. Bull. 208, p. 103; Rept. 1906, p. 271.

Colorado Beetle—Adults and larvae devour the leaves. Spray with lead arsenate as soon as injury is apparent. May be used in Bordeaux mixture. Bull. 208, p. 106; Rept. 1911, p. 311.

Three Lined Potato Beetle—Larvae feed upon the leaves and carry their black excrement on their backs. Spray with lead arsenate. Bull. 208, p. 109.

Stalk Borer—Larva tunnels inside the stalk. Burn infested vines. See Dahlia. Bull. 208, p. 111

pearing in large numbers suck the sap from shoots and stems, causing much damage in 1917. Spray with soap and nicotine solution. Bull. 208, p. 115.

Fungi, etc.

Black Leg—Causes a black rot of stem below ground; plants more or less stunted with yellowish curled foliage; occasionally rots tubers. Usually nly scattered plants appear in the field, not spreading to the ealthy. Soaking seed in formalin as for scab said to be helpful. Rept. 1914, p. 21.

Blight or **Downy Mildew**—Causes a sudden blackening of the leaves, and often death of vines, from July to September in moist seasons; usually shows a slight whitish growth of fungus on the under side of the leaves; rots tubers. Spray with Bordeaux before the trouble appears, about July 1st, and keep vines well covered to the end of the season. Three to five sprayings by hand or five to seven by power sprayer are necessary. After last cultivation thoroughly ridge up the rows to help keep the spores from washing down to he tubers. Early varieties often escape blight by maturing before ts appearance. Repts. 1904, p. 363; 1905, p. 304; 1909–10, 739; 1915, p. 470; 1916, p. 355; Bull. 214, p. 411.

Mosiac—Shows as a more or less conspicuous yellow-green mot-ling of the leaves. A physiological disease not well understood. ew here but apparently not so injurious as in some other places. o not save tubers for planting from hills showing this trouble. ull. 222, p. 464.

pearance on surface of tubers. Soak uncut seed-tubers one hour in formalin (formula C). Formalin fumes (see Less-Used Fungicides) are often used when large quantities are treated. Care in filling space sufficiently, however, is necessary to avoid injury by "pitting" from absorption of fumes. Corrosive sublimate is again recommended by some investigators especially where the black scurf (Rhizoctonia fungus) also occurs on the tubers, as this treatment seems more effective against the latter. Hot corrosive sublimate or formalin for short periods has also been recommended for potato tuber diseases. Avoid planting on infected land, by systematic rotation. The use of lime, wood ashes, and various barnyard manures will increase the amount of scab. The same trouble occurs on beets and turnips. Fig. (B). Repts. 1890, p. 81; 1891, p. 153; 1894, p. 118; 1895, p. 166; 1896, p. 246; 1909–10, p. 744.

Tip Burn—Causes leaves to die at tip and margins and roll up; often mistaken for true blight. This is a physiological trouble due to drought or sudden change from moist to very hot bright weather. Cultivate thoroughly and often to conserve moisture. Spray with Bordeaux as for blight, as this often helps to increase yield by lengthening life of leaves. Rept. 1909-10, p. 742.

PRIVET.

Insects.

Privet Leaf Folder—Larvae web together terminal leaves and feed inside. Clip off and destroy infested shoots. Spray with lead arsenate. Rept. 1913, p. 223.

Privet or **Lilac Borer**—See Lilac.

Fungi, etc.

Anthracnose—Forms small cankers on stems causing parts above to wilt and die. Usually found in nurseries on recently transplanted European privet. Prune off and burn infected branches; if bad spray with Bordeaux. Rept. 1914, p. 22.

Winter Injury—Shows in spring by stems usually being killed down to base or snow line. Cut off dead stems below injury and a vigorous new growth will result if roots are not injured. Rept. 1904, p. 326.

Insects.

QUINCE.

Round-Headed Borer—See Apple.

Quince Curculio—Grubs infest growing fruit and adults feed upon it causing it to be knotty. Jar the trees same as for plum curculio. Spray with lead arsenate.

Aphid—See Apple.

Fungi, etc.

Black Rot—Rots the fruit, often beginning at the blossom end; also kills twigs and branches. In the fall or spring cut off and burn all dead branches. Give three sprayings, as for leaf blight, with Bordeaux mixture.

Blight—See Pear.

Leaf Blight—Forms rounded, often confluent, reddish-brown spots with central black dots on leaves and fruit, the former often shedding prematurely and the latter cracking irregularly. Spray with Bordeaux just before blossoms open, again soon after they fall, and follow with 1 or 2 additional treatments at intervals of about 2 weeks, according to the weather. This fungus also occurs on pear. Repts. 1890, p. 99; 1891, p. 150.

Rust—Produces small clustered cups, with fringed borders and filled with orange spores, on fruit, young twigs and less frequently on leaves. Cut off and burn infected twigs and fruit. Look for infected cedars in neighborhood. See Apple Rust.

Insects.

RADISH.

Maggot—See Cabbage.

Aphid—See Turnip.

Fungi.

Club Root—See Cabbage.

Insects.

RASPBERRY.

Raspberry Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore. Rept. 1918, p. 329.

Cane Borer—Larva tunnels inside the canes. Cut and burn infested canes.

Raspberry Fruit-Worm—Brown beetles feed upon buds, leaves and blossoms, and white larvae adhere to berries at picking time. Spray with lead arsenate when beetles first appear.

Fungi, etc.

Anthracnose—Shows as more or less confluent whitish spots, with purplish borders, on the stems. In spring, before buds swell, cut out and burn all badly infected canes and then spray with Resin-Bordeaux. If disease is very bad, spray again when young shoots are about six inches high, and repeat in 10 to 14 days. Aim chiefly to cover the young shoots with the spray. After fruit is gathered, again remove any badly infected canes. Cultivate ground thoroughly to promote vigorous growth of canes. Rept. 1899, p. 274.

Crown Gall—See Blackberry.

Rust—See Blackberry.

above to wilt. In the old canes and near the pruned ends, the fungus often develops a brownish coating of spores around each small imbedded fruiting receptacle. The green berries often dry up without apparent cause, due to inoculation by insects. Spraying has not proved very satisfactory. Old and diseased canes should be removed and burned after the fruiting season and again early in spring. Rept. 1906, p. 321.

Yellows—Causes foliage to become more or less crinkled, and mottled with a sickly yellowish color. Plants gradually become worthless. Spraying does not seem to help this trouble, which apparently is of similar nature to peach yellows. Dig out plants with the yellows. Propagate only from perfectly healthy ones.

RHODODENDRON.

Insects.

Rhododendron Lace Bug—This bug sucks the sap from the under side of the leaves, which are usually colored brown by its excrement. Spray with nicotine solution or kerosene emulsion. Rept. 1910, p. 708.

Fungi, etc.

Leaf Scorch—Shows as dead marginal areas of varying width usually appearing suddenly. Plant in shade; keep ground mulched; water if necessary in dry weather by soaking ground beneath mulch. Rept. 1914, p. 23.

ROSE.

Insects.

Rose Slug—Eats away the green portion of the leaves. Spray with hellebore, lead arsenate or nicotine solution.

Rose Midge—Larvae distort young leaves and flower buds in greenhouses. Apply tobacco dust to the soil and fumigate nightly with tobacco stems or nicotine paper.

Rose Chafer—See Grape.

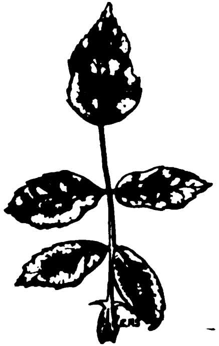
Spray with nicotine solution and soap.

Rose Scale—Whitish circular shells on the stems contain insects which suck the sap. Cut and burn worst infested canes. Spray with nicotine solution and soap. Bull. 151, p. 11; Rept. 1905, p. 241.

Aphid or **Green Fly**—Sucks sap from the leaves and stems. Spray with nicotine solution.

Fungi, etc.

Crown Gall—Occurs very frequently on rose roots, especially those of Manetti stock. There is some question how much infected plants eventually suffer. See Plum. Rept. 1911-12, p. 355.



Leaf Blotch—Forms large purple-black blotches on leaflets, which often turn yellow and fall off. For greenhouse treatment paint hot water pipes with mixture of sulphur and oil. Potassium sulphide or commercial lime and sulphur can be sprayed on the foliage. Spraying out of doors can be done with Bordeaux, if there is no objection to the sediment on leaves. Rept. 1903, p. 355.

Mildew—Develops a white powdery or cobweb-like growth on the young leaves, which become more or less distorted and fall off; occasionally blasts blossoms of certain varieties. Tea roses especially susceptible. Treat same as for leaf blotch; or dust flowers of sulphur over the leaves; be careful in airing greenhouses. Rept. 1903, p. 356. Bull. 222, p. 474.

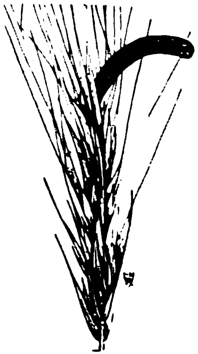
RUTABAGA, See TURNIP.

RYE.

Insects.

Army Worm—See Grass.

Wheat Midge—See Wheat.



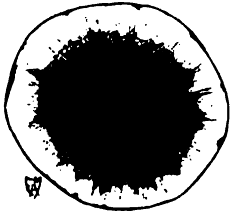
Fungi.

Ergot—Forms conspicuous, elongated, purplish sclerotia, usually one in the spike, most common in volunteer rye, but occasionally in cultivated fields. Keep these sclerotia out of cattle feed as they may cause abortion and other troubles.

Powdery Mildew—Shows as a thick grayish felt on the leaves with fruiting bodies as blackish embedded specks. Causes premature death of leaves; often associated with rust. No practical remedy. Rept. 1909-10, p. 735.

SALSIFY.

Fungi, etc.

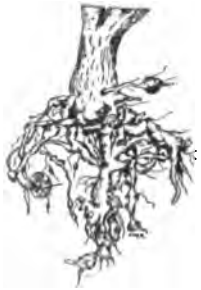


Soft Rot—Forms a soft rot of the interior tissues of the roots running down from the crown and turning them a darker color. Usually occurs after storage. Same bacteria cause soft rots in a variety of plants. Avoid contaminated manure and too much rotting humus in the fields; store under dry cool conditions, allowing sufficient ventilation. Rept. 1914, p. 25.

SNAPDRAGON.

Insects, etc.

Leaf Mites—Cause leaves to curl and plants do not blossom. Spray with nicotine solution and soap, same as for Cyclamen. Rept. 1914, p. 176.



Root-Knot Eelworm—Causes irregular swellings on the roots where the eelworms are present, with resulting premature decay and sickly appearance of parts above ground. Worst in greenhouses and hot-beds as this far north the nematodes are killed in unprotected ground over winter. Attacks roots of a great variety of cultivated plants. Purchase only healthy plants; change infected soil if possible, dry out thoroughly in summer, leave out doors over winter or sterilize with steam; avoid contamination of soil with infected refuse. Rept. 1915, p. 452.

Fungi.

Anthracnose—Shows as whitish spots with distinct purplish border on leaves and stems; spots often running together. Select seed and cuttings only from healthy stock; pick off and burn infected leaves. Spray with Bordeaux.

Rust—Forms reddish-brown, roundish pustules chiefly on under side of leaves causing tissues above to become yellow spotted. Appearing in greenhouses and causing more or less injury according to prevalence. Treat as for anthracnose. Rept. 1915, p. 443.

SNOWBALL.

Insects.

Aphids—Suck sap from the leaves causing them to curl. Use nicotine solution and soap as a spray or dip.

SOY BEAN.

Fungi, etc.

Bacterial Leaf Spot—Forms small, dark, reddish-brown angular spots frequently merging into larger areas. Certain varieties appear more susceptible than others, Ito San being one of the

worst. Grow least susceptible varieties and if possible purchase seed from uninfected fields.

Crinkling Chlorosis—Shows as crinkling or yellowish-green mottling of leaves, or both together. Plants less vigorous than normal ones. Hollybrook variety apt to show trouble most. Treatment same as in preceding.

SPINACH.

Insects.

Spinach or **Beet Leaf-Miner**—See Beet.

SPIRAEA.

nsects.

Aphids—Suck sap from the new shoots. Use nicotine solution nd soap as a spray or dip.

SPRUCE.

nsects.

Spruce Gall Aphid—Forms galls at the base of the new growth n Norway and other spruces. Spray in the late fall or early spring with nicotine solution and soap or with kerosene emulsion. Rept. 1906, p. 302.

Spruce Bud Moth—Larva feeds on leaves of terminal shoots of the branches causing much damage. Spray with lead arsenate. Rept. 1912, p. 291.

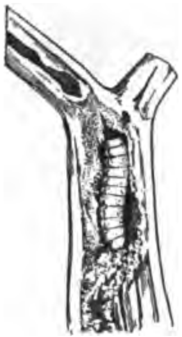
SQUASH-PUMPKIN.

Insects.

Squash Lady-Beetle—Both adults and larvae devour the leaves. Spray with lead arsenate. Bull. 181, p. 11; 216, p. 42; Rept. 1908, p. 810.

Striped Cucumber Beetle—See Cucumber.

bug three-fourths of an inch in length sucks the sap from the under side of the leaves, causing them to wilt and die. Spray with kerosene emulsion to kill the young. The old bugs may be trapped by placing boards or shingles on the ground, which should be visited each morning and the bugs killed. Bull. 216, p. 44; Rept. 1908, p. 811.



Squash-Vine Borer—Larva tunnels in the base of the stem, causing decay. Cut slits lengthwise in the stem and kill borers. Cover the joints of the vine with earth so that new shoots may be formed to support the plant. Grow a few early plants for traps, and destroy them. The main crop should be planted rather late. Bull. 216, p. 39; Rept. 1908, p. 806.

Fungi.

Anthracnose—See Watermelon.

Storage Rots—Caused by various fungi that are best held in check by storage under conditions with minimum of heat and moisture.

Wilts—Cause leaves of the plants to wilt and then dry up, sometimes all of the vine thus suddenly dying. If a cross section of the stem shows a slight milky and sticky exudation, it is caused by bacteria that clog up the water ducts. Fungi in the ducts or insects at the roots may cause similar trouble. Heavy manuring often develops these troubles. Spraying is of little value except as it may keep off insects which inoculate the plants with the bacteria. Use enough seed to allow for loss by wilt and pull up and destroy all the wilted vines as they appear. Rept. 1903, p. 359.

STRAWBERRY.

Insects.

Strawberry Sawflies—Larvae devour leaves. Spray with lead arsenate or hellebore.

Strawberry Weevil—Small snout beetles; females cut off blossom buds of staminate varieties when ovipositing. Plant pistillate varieties in part. Dust heavily with lead arsenate and sulphur (1–5.)

Strawberry Crown Borer—Grub tunnels and feeds in crown of plant. Practice crop rotation. Burn over infested field in fall.

Strawberry Flea Beetle—Adults eat holes through the leaves. Spray with lead arsenate.

Strawberry Leaf Roller—Larva rolls leaf and feeds inside. Spray with lead arsenate. Burn fields and plow abandoned fields as soon as crop is harvested.

Strawberry Root Aphid—Sucks sap from leaves and roots, killing plants. Set clean plants on land not infested. Spray with nicotine solution and soap.

Strawberry White Fly—Sucks sap from leaves. Underspray with nicotine solution and soap.

White Grubs—See Grass.

Fungi.

Leaf Spot and **Blotch**—Cause conspicuous discolored spots, the former usually with whitish centers and purplish borders, and the latter with dark centers. Glen Mary sometimes severely injured by latter fungus. Renew the beds frequently. In the late fall or early spring cut off leaves with mower, add a little straw where necessary, and burn over beds. Spray with Bordeaux two or three times before blossoming, beginning last of April and repeating weekly, and once after blossoming is over. Repts. 1903, p. 360; 1914, p. 5.

Powdery Mildew—Covers leaves (more frequently on under, but more conspicuously, when present, on upper surface) with cobweb-like growth, often causing them to become stiff and curled inward. When necessary, this can probably be controlled with Bordeaux if sprayed before abundant. Rept. 1905, p. 276.

SWEET PEA.

Insects.

Aphids—See Pea.

White Fly—See Tomato.

Fungi.

Dampening Off—Rots off stem just below ground causing vines to turn yellow and finally die. Plant in well drained soil; place well rotted manure deep in ground below the seed; avoid excessive watering; spray base of vines and ground with Bordeaux; change beds if appearing yearly. Rept. 1907, p. 359.

SWEET POTATO.

Insects.

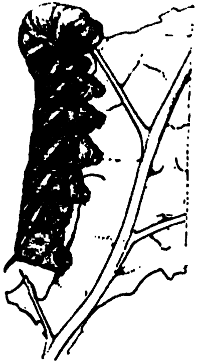
Tortoise-Shell Beetles—Feed upon leaves. Spray with lead arsenate. Bull. 208, p. 110.

SYCAMORE.

Fungi.

Anthracnose—Kills young leaves in the spring; causes dead areas of irregular shape in tissues of older ones often following veins. If thought advisable to spray, use Bordeaux on the leaves as soon as showing and repeat when half grown.

TOBACCO.

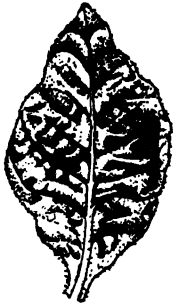


Insects.

Tobacco or **Tomato Horn-Worms**—Large green caterpillars with horn on the tail devour the leaves. Practice hand picking or spray the plants with lead arsenate. Rept. 1906, p. 269.

Flea Beetle—Adults eat holes through the leaves. Spray upper and under surface heavily with lead arsenate. Bull. 208, p. 103; Rept. 1906, p. 271.

Cut Worms—See Tomato.



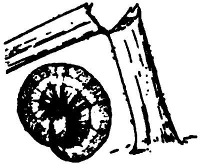
Fungi, etc.

Calico—Causes the leaves to become irregularly mottled with a lighter green color and makes a very inferior tobacco. Frequently infected leaves finally show numerous, irregular, often merging, brown spots known as "rust." While calico is a physiological disease, due to injurious enzymes, it can be communicated to a healthy plant through contact with a very small amount of juice from a diseased plant. Care, therefore, is necessary after handling diseased plants in touching healthy ones. Never use tobacco water or tobacco stems on the seed beds. If calico shows in a seed bed, pull up all suspicious plants and those surrounding them. If troubled year after year, sterilize the seed beds or change them, and never make them on land used for tobacco the year before. When transplanting, wash the hands occasionally with soap and water. Repts. 1898, p. 242; 1899, p. 252; 1914, p. 357; Bull. 166, p. 10.

Dampening Off—Due to various fungi which rot off the seedlings close to the ground, and cause them to fall over. Keep air of beds as dry as consistent with good growth by care in watering and ventilating. If trouble starts in spots, take out all infected plants and refuse there.

Root Rot—Shows in seed beds by dwarfed "rosette" plants whose roots have been largely rotted off. Occasionally it does more or less damage in fields, especially in alkaline or water soaked soils; a short rotation is advisable in such cases. Sterilize seed beds with steam or treat with formalin (formula D). Repts. 1906, p. 342; 1907, p. 363.

Wild Fire—Shows first in lower leaves as small, roundish, yellow spots. In time these grow larger, turn darker, and irregular dead areas appear more or less prominently. This disease is caused by bacteria, is favored by wet weather and is apparently new to the state. It is carried on the seed and later may be readily transferred from infected places in the field by certain insects and the wind. Care should be used to select seed only from disease-free fields and sow this seed in sterilized seed beds. Where doubtful seed is used this should be soaked for 15 minutes in 1 pint of water to which is added 1 oz. of formalin, stirring the seed during the treatment. Drain off the liquid, wash seed in pure water several times and dry before storing. Old cloth used previously on infected beds should be boiled in water before used again.



TOMATO.

Insects.

Cut Worms—Eat off plant near ground or climb the plant and devour the leaves. Place around field poisoned bait or bran mash containing arsenic. Trap cut worms with small piece of board. Rept. 1906, p. 264; Bulls. 190, p. 18; 208, p. 112; 216, p. 43.

Tomato or **Tobacco Horn-Worm**—See Tobacco.

Flea Beetle—See Potato or Tobacco.

Potato Aphid—See Potato.

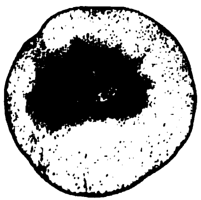
Stalk Borer—See Dahlia.

White Fly—Sucks the sap from under side of leaves. Spray under side of leaves with soap and water. Fumigate greenhouses with hydrocyanic acid gas (1 oz. to 1000 cubic ft.). Bulls. 140; 216, p. 50; Rept. 1902, p. 148.

Fungi, etc.

Mosaic—Rept. 1908, p. 857. See Calico of Tobacco.

Leaf Spot—Produces on leaves and stems numerous, small, dark spots, often with white centers. Begin spraying with Bordeaux about the middle of July, making 3 or 4 applications at intervals of 10-14 days. This usually develops too late in the season here to cause serious damage.



Point Rot—Causes the green fruit to rot at bloom end, showing a large, firm, dark-brown area. Claimed to be a physiological trouble. Frequently bad in very dry seasons. In greenhouses sub-irrigation is said to prevent it. Spraying, apparently, is of little value. Considerable difference exists in varieties as to susceptibility.

Scab—Occurs most commonly in greenhouses, covering under surface of leaves more or less abundantly with an olive-brown growth which finally kills the tissue above. Spray with Bordeaux, picking ripe fruit before each of the later treatments.

Wilt—Occurs here chiefly in greenhouses; plants turn yellow and slowly wither up; fungus may finally show on dead stem and fruit as pinkish growth. Caused by fungus clogging ducts and cutting off water supply to leaves; in young stage presence shown by blackened bundles where stems are cut across. Change soil if appearing yearly; do not sow seeds from infected plants as they can carry the disease. Spraying of no value. Rept. 1903, p. 366.

TULIP TREE.

Insects.

Tulip Tree Scale—Large brown hemispherical soft scales on bark, sucking the sap, especially on lower branches. Spray with lime-sulphur when trees are dormant. Bull. 151; Repts. 1905, p. 239; 1912, p. 294.

TURNIP-RUTABAGA.

Insects.

Cut Worms—See Tomato.

Cabbage Maggot—See Cabbage.

Turnip Aphid—Green aphids on under side of leaves sucking the sap. Underspray with soap and water or nicotine solution. Rept. 1916, p. 98.

Fungi, etc.

Club Root—See Cabbage.

Soft Rot—Causes an interior soft decay of roots, etc., of a variety of vegetables, such as turnips, salsify, parsnips, carrots, celery. Very wet seasons and imperfect storage conditions are usually the starting point of these troubles. Store under best possible conditions for keeping down heat and moisture. Keep contaminated refuse out of manure pile. Rept. 1914, p. 25.

Phoma Rot—Appears usually after storage, causing conspicuous, dry, sunken, subcircular, black spots scattered over roots. Fruiting pustules show as black dots. Store roots in cool dry place and not too deeply in the piles. Practice yearly rotation and keep refuse from manure pile. If necessary, use only artificial fertilizers. Rept. 1912, p. 355.

VIOLET.

Insects, etc.

Violet Midge—Larvae in curled edges of new leaves. Fumigate every other night with hydrocyanic acid gas (½ oz. to 1000 cu. ft.)

Violet Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Eelworms—Form galls on the roots. Plant in new soil or sterilize the old soil by steam. Add plenty of air-slaked lime to the soil. See Snapdragon.

Fungi.

Spot Disease—Shows as whitish round spots on the leaves. Spray field plants early in fall with Bordeaux. Select only best stock for greenhouse; remove *all* affected leaves before transplanting. When plants become established, spray again with Bordeaux. Be careful about watering plants, and, by proper ventilation and heat during September to November, keep atmosphere of house from ever becoming too moist.

WALNUT.

Insects.

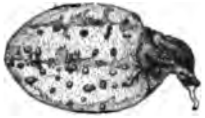
Walnut Caterpillar—Clusters of black caterpillars covered with whitish hairs strip the branches and finally the trees in August. Spray with lead arsenate. Clip off twigs when caterpillars are small, and kill by crushing. Repts. 1914, p. 191; 1917, p. 326.

Walnut Weevil or **Curculio**—Adults feed at base of leaf stems. Larvae tunnel in new shoots and infest the fruit of Persian and Japanese walnuts. Spray with lead arsenate. Rept. 1912, p. 240.

Walnut Bud Moth—Larvae feed upon tender leaves and shoots, webbing them together. Spray with lead arsenate. Rept. 1912, p. 253.

WATERMELON.

Fungi.



Anthracnose—Shows as more or less abundant, dark, sunken spots or areas on the fruit. Also infects leaves in spots. Usually appears here too near end of season to cause sufficient injury to warrant spraying; spray also fails to adhere well to the fruit. Rotation and removal of rotting melons from field may possibly be helpful restrictive measures.

WHEAT.

Insects.

Army Worm—See Grass.

Hessian Fly—Maggots burrow in sheath of a leaf at base of stem, causing the stalks to turn yellow and die. Plant rather late—say about September 1st.

Wheat Midge—The fly lays eggs on the chaff and the maggots feed upon the developing kernels, so that the heads ripen early and produce no grain. Burn stubble before plowing. Plow infested fields deeply in the fall. Rept. 1917, p. 366.

Green Bug or **Aphid**—Green aphids suck the sap from leaves. Destroy in early fall all volunteer wheat and oats. Practice crop rotation.

Fungi.

Black Stem Rust—See Oats.

Leaf Rusts—Form small, dusty, orange-colored outbreaks on leaves, etc., and later darker and firmer mature stage. Several closely related species on barley, rye, and wheat but quite distinct from the black stem rust. Some varieties are more resistant than others to these various grain rusts. No effective treatment.

Loose Smut—Destroys entire head turning it into a dusty olive-black mass that is dissipated in time. Severe hot water treatment partially effective. See Oats.

Stinking Smut—Fills the apparently scarcely changed seeds with a dusty mass of spores. Spores often found more or less abundantly in middlings and other feeds containing wheat, and their presence in amount indicates poor quality, and may have some connection with complaints of injury to stock fed on these. Use formalin treatment. Rept. 1909-10, p. 736.

WILLOW.

Insects.

Fall Web Worm—See Pear.

Spiny Elm Caterpillar—See Elm.

Poplar Tent-Maker—See Poplar.

Poplar and **Willow Curculio**—See Poplar.

Sawflies—Larvae devour leaves. Spray with lead arsenate.

Aphids—Large reddish aphids congregate on twigs in fall, and suck the sap. Spray with kerosene emulsion or nicotine solution and soap.

Oyster-Shell Scale—See Apple.

Fungi.

Rusts—Occur on the leaves; similar in appearance and closely related to those on poplar. The alternate host for one species is the larch and apparently there is another whose alternate host is not yet determined. Rept. 1915, p. 450.

MANUFACTURERS AND DEALERS IN SPRAY APPARATUS AND SUPPLIES.

Prospective purchasers should write to these firms for catalogues and prices.

MANUFACTURERS OF SPRAYING MACHINES.

spinwall Manufacturing Co., Jackson, Mich. (Hand and power potato sprayers.)
arnes Mfg. Co., Mansfield, Ohio. (Hand and power sprayers.)
ateman Mfg. Co., Grenloch, N. J. (Iron Age sprayers for hand and power.)
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Hayes Pump and Planter Co., Galva, Ill. (Spray pumps.)
Humphryes Mfg. Co., Mansfield, Ohio. (Hand and power pumps.)
Hurst Mfg. Co., H. L. Greenwich, Ohio.
Leggett & Brother, 301 Pearl St., New York. (Hand and power dusting machines.)
Myers & Brother, F. E., Ashland, Ohio. (Hand and power pumps.)
Niagara Sprayer Co., Middleport, N. Y. (Dusting machines.)
Rumsey Pump Co., Ltd., 49 Federal St., Boston, Mass. (Hand and power pumps.)
Spramotor Co., 107-109 Erie St., Buffalo, N. Y. (Hand and power outfits.)
Ward-Love Pump Corporation, Rockford, Ill. (Pumps for all purposes.)

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owker Insecticide Co., 43 Chatham St., Boston, Mass. (Insecticides and fungicides.)
evoe & Raynolds Co., Inc., 101 Fulton St., New York. (Arsenical poisons.)
rost Insecticide Co., 20 Mill St., Arlington, Mass. (Spray chemicals and apparatus).
eneral Chemical Co., 25 Broad St., New York. (General insecticides and fungicides, atomic sulphur and B. T. S.)
lidden Co., Cleveland, Ohio. (Insecticides and fungicides.)
rasselli Chemical Co., 80 Maiden Lane, New York. (Insecticides and fungicides.)
Heil Chemical Co., Henry, St. Louis, Mo. (Spray chemicals.)
Hemingway & Co., Inc., Bound Brook, N. J. (Arsenical poisons.)
Interstate Chemical Co., 12-20 Bay View Ave., Jersey City, N. J. (Insecticides and fungicides.)
Kentucky Tobacco Product Co., Louisville, Ky. (Nicotine solution.)
Kil-Tone Co., The, Vineland, N. J. (Insecticides and fungicides.)
Lavanburg Co., Fred L., 100 William St., New York. (Arsenical poisons.)
Leggett & Brother, 301 Pearl St., New York. (Insecticides and fungicides.)
Mechling Bros. Mfg. Co., Line St., Camden, N. J. (Insecticides and fungicides.)
Merrimac Chemical Co., 33 Broad St., Boston, Mass. (Lead arsenate.)

ational Color and Chemical Works, Selling Agents for Taylor Chemical Co., 59th St. & 11th Ave., New York. (Carbon disulphide.)

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Sherwin-Williams Co., 601 Canal Road, Cleveland, Ohio. (Lime-sulphur and arsenical poisons.)

Smith Co., H. J., Utica, N. Y. (Insecticides and Fungicides.)

Thum Co., O. & W., Grand Rapids, Mich., 15 India St., Boston, Mass. (Tanglefoot.)

Vreeland Chemical Mfg. Co., 50 Church St., New York. (Insecticides and fungicides.)

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Dealers in spraying materials can usually be found in each town. Some of the larger firms are mentioned below.

pothecaries Hall Co., 24 Benedict St., Waterbury. (Wholesale druggists.)

arnes Bros., Yalesville. (Insecticides and fungicides.)

adwell & Jones, 1084 Main St., Hartford. (Pumps, insecticides and fungicides.)

rasselli Chemical Co., River St., New Haven. (Insecticides and fungicides.)

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ewell, Harvey, Cromwell. (Agent for Hardie hand and power sprayers.)

Leete Co., The Chas. S., 299 State St., New Haven. (Wholesale druggists.)

Lightbourn & Pond Co., 39 Broadway, New Haven. (Pumps, insecticides and fungicides.)

Platt Co., The Frank S., 450 State St., New Haven. (Pumps, insecticides and fungicides.)

Sisson Drug Co., 729 Main St., Hartford. (Spraying machines and insecticides.)

Whittlesey Co., The Chas. W., 259-271 State St., New Haven. (Wholesale druggists.)

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NEW HAVEN, CONN.

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G. P. CLINTON, Botanist

CONNECTICUT
Agricultural Experiment Station
NEW HAVEN, CONN.

BULLETIN 225 JANUARY, 1921

ENTOMOLOGICAL SERIES, No. 28

A STUDY OF THE BULB MITE.

By Philip Garman.

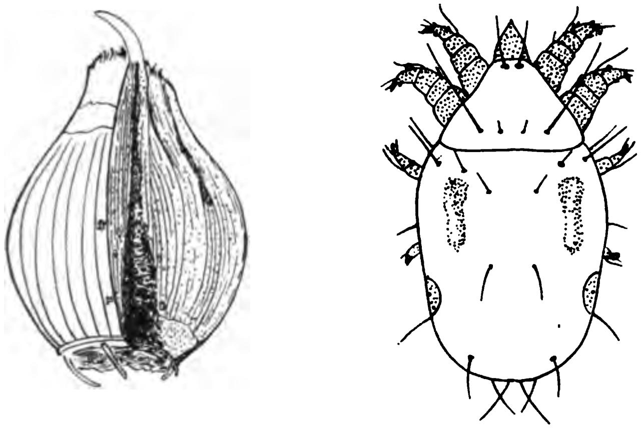

Figure 1. Section of infested bulb, and a mite greatly enlarged.

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Press of The Wilson H. Lee Company.

A Study of the Bulb Mite.

(*Rhizoglyphus hyacinthi Banks.*)

By PHILIP GARMAN, PH.D.

Inspection of over a million bulbs in Connecticut during 1919 brought to light the significant fact that nearly all shipments contained the bulb mite *R. hyacinthi* Banks. In many shipments only a few infested bulbs were found, but in others as high as fifteen to twenty per cent. were apparently destroyed. Shipments were, however, frequently delayed in transit according to reports, a state of affairs doubtless responsible for the poor condition of many bulbs when they arrived at their destination. Rotten bulbs, too, are not always the result of mite infestation alone, there being several other causes of rot and disease—but the almost universal presence of the mites in decayed bulbs has led to the present study of the life history, habits and control of the pest.

Woods[1] claims that the Bermuda lily disease, caused in part by mite infestation, results in a yearly loss of 20 to 60 per cent. of the entire crop where the plants are forced. Destruction of bulbs has also been noted by many other American and European workers.

The injurious effects of the species in Connecticut were first described in the report of the State Entomologist for 1915[2], when 3000 Easter lilies were destroyed. Since then, no specific case in which extensive damage was done, has been reported to this office, but there is doubtless a small per cent. of loss each year which should be prevented by proper inspection, care and treatment of the mite-infested bulbs.

DISTRIBUTION OF THE SPECIES.

The bulb mite has been reported in foreign shipments to various states and to Canada. Shipments of bulbs to Connecticut come mostly from France, Belgium and Holland, but what is apparently the same species was found in one shipment received from Japan. It has also been reported in shipments of bulbs from the Bermuda Islands and thus seems to have a fairly wide distribution.

THE NAME OF THE BULB MITE.

Banks[3] in 1906, listed under the name of *Rhizoglyphus hyacinthi* Boisduval a species of mite which he found in bulbs. Since that time Americans have religiously followed the name *hyacinthi* in preference to the name *echinopus* of European authors. Michael[1], however, places *hyacinthi* as a synonym of *echinopus*, with the remark that *hyacinthi* of Boisduval is a *nomum nudum* being listed without description. Michael is correct in this statement, since the original description given by Boisduval is very meager and is not sufficient for purposes of identification. However, the description of *echinopus* given by Fumouze and Robin[2] shows that the latter may also have considered a different species; for the species in hand differs from it (and also Michael's description) in important particulars.

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[1] U. S. Dept. Agr. Div. Veg. Phy. & Path. Bul. 14: 1897.

[2] Conn. Agr. Exp. Sta. Rep. 190: 1915.

[3] Banks, N., Revision of the Tyroglyphidae, U.S.D.A. Bur.Ent.Tech. Ser.13: 21: 1906.

The most striking of these characters are the chitinous thickenings on the fourth pair of legs, which occur both in normal and heteromorphic males. Michael states that the only species bearing this character is *R. crassipes* Haller, which was originally described as an American species[3], but *crassipes* differs (in other particulars), from our species, and we are forced to conclude that either the chitinous thickenings have been overlooked or the species may be different from all described species. Inasmuch as Michael (l. c., p. 83) says emphatically that "there are not any suckers on the leg of the male of any species except *R. crassipes* Haller" we are able to conclude that he must have examined the species which he described, for this particular character. Examination of material from the U. S. National Museum shows chitinous thickenings on the fourth pair of legs in *R. hyacinthi* and *R. rhizophagus*. The rather frequent presence of the dimorphic male excludes the species in hand from *rhizophagus* and refers it to *hyacinthi*. As already intimated, a search through Boisduval's works has revealed no adequate description of this species and either his name *hyacinthi* must be disregarded or the authority changed from Boisduval to Banks. The latter course is to be preferred and the name *Rhizoglyphus hyacinthi* Banks instead of *Rhizoglyphus hyacinthi* Boisduval should be used, since Boisduval's name cannot be connected with any known species.

For convenience the description given by Boisduval is quoted herewith. Bank's description of the species is found in Bur. Ent. Tech. Ser. Bul. 13, p. 21, 1906 (pl. V fig. 49).

DESCRIPTION BY BOISDUVAL.

Entomologie Horticole p. 86: 1867.

"Nous ne trouvons mentionnè nulle part l'acarus de la Jacinthe, nous ne savons pa s'il n'a pas deja ete observé par quelque naturaliste. Nous lui donnons le nom provisoire d'acarus des Jacinthes *Acarus hyacinthi.*"

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[1] Michael, A. D., British Tyroglyphidae II: p. 85: 1903.
[2] Jour. Anat. Phys., V: 287: 1868.
[3] Haller, Archiv Naturgeschichte, 50: 218: 1884.

General Description.

Egg (Fig. 2, No. 6),—The egg is ellipsoidal, white and semitransparent; .12 by .07 mm. in size.

Larva (Fig. 2, No. 2),—Small, white, somewhat ovoid in shape; genital suckers absent. Cephalo-thorax with two long setae on the frontal margin above, and two near the caudo-lateral angle; no minute bristles between the latter as in the adult; venter of the thorax with a clavate sense organ (Fig. 2, No. 3) between the bases of the first and second coxae on each side and small setae mesad of these; front tarsi with strong spines as in the adult, but the clavate hair much longer than the spine immediately beyond it; tip of the tarsus with three slender setae; front tibiae with the usual long setae on the dorsum, the patella (3rd segment from end beginning with tarsus) each with two shorter setae on the dorsum as in the adult. Abdomen with one pair of legs, the tarsi of each of which bears a long heavy spine and longer seta on the dorsal surface and three spines on the ventral; tarsal claw very stout; tibiae each bearing a single long seta on the dorsal surface; lateral margins of the abdomen with four setae on each side and a pair near the anal opening.

Size shortly after emergence from the egg, .15-.2 by .1 mm., full grown, .25 by .15 mm.

Protonymph (Fig. 2, No.1),—Similar to the larva in size and shape but larger and provided with four pairs of legs instead of three; rostrum as in adult; cephalo-thorax as in adult; with two long setae on the frontal margin of the dorsum and two near the caudo-lateral angle; no minute setae between the latter; the front tarsi have, in common with the adult, a minute clavate hair at the base and to one side of the large clavate hair; and between the larger clavate hair and the spine (immediately beyond) is a smaller spine about one-fifth the length of the latter; tip of front tarsi with three slender setae each. The fouth pair of legs has only one seta at the tip of the tarsus and there is no dorsal spine on that segment; however, there is a strong lateral spine and a ventral spine. Judging from the spines and setae on the tarsi of leg three in the larva and the protonymph, the fourth pair of legs of the protonymph must grow in behind the third pair of the larva.

This stage is most easily distinguished from the tritonymph, which it resembles more closely than other stages, by the appearance of the genital suckers. In the protonymph only two make their appearance while in the tritonymph there are three or four (see Fig. 2, No. 5). There is also some difference in the tarsi of the fourth pair of legs, the latter possessing no dorsal spine in this stage.

Length full grown, about .4 mm., width about .2 mm.

Deutonymph or hypopus (Fig. 2, No. 11),—Oval in shape, dorsum convex; venter flat; color brown, the body heavily reinforced throughout with chitin. Rostrum apparently reduced to a small cylindrical projection entirely covered by the cephalo-thorax; distal end of rostrum with two long setae, and a smaller one at the base of each. Mouth parts wanting; cephalo-thorax with two long setae on the front margin placed closely together, and about the same length as the long setae of the rostrum; legs for the most part without the heavy spines of the adult, the latter replaced in most cases by setae; tarsal claws long, curved rather sharply; tarsi of first pair of legs with four slender setae at tip and two near middle of ventral surface. There is also a heavy spine on the ventral surface; a large clavate hair nearly half as long as the segment, and a smaller clavate hair and small seta on caudal surface near the larger one. In front of the larger clavate hair there is also a long seta; front tibia with a long seta on dorsum and a single spine on each side; patella with a single seta at tip instead of two, as in all other stages. Abdomen with conspicuous expulsory vesicles on either side; margin composed of thick heavy chitin, which shows prominent striations under magnification; venter with conspicuous suckers as in Fig. 2, No. 11, one on each side of the anal opening, two caudad of this, then a row of four, and finally two more Surrounding the eight caudal suckers is a squarish ring which is thickened at each of its four corners, making it appear as if four additional suckers were present; conspicuous lines of chitin on the venter, extending cephalo-mesad from the anal opening and each coxa of legs III and IV; third and fourth pair of legs short and usually hidden by the overhanging body wall when viewed from above; tarsi with four setae and two heavy spines at tip; tibiae with a long seta near tip, on dorsum; margin of abdomen with four, minute marginal setae.

Length, .2-.3 mm. Width .13-.18 mm.

Tritonymph (Fig. 2, No. 9),—Color white, translucent or semiopaque, legs brown or tinged with pink.

Rostrum and cephalo-thorax agreeing in nearly all particulars with the adult female. Abdomen as in the adult as regards setae; but the genitalia undeveloped; the genital suckers consist of four indistinct suckers closely approximated (Fig. 2, No. 9).

Length .5-.6 mm, width .3-.3.5 mm.

Adult (Fig. 3, Nos. 12-15; Fig. 2, Nos. 4, 5, 7 and 8),—Color white, body somewhat transparent; legs epimera and rostrum brown, sometimes with a pinkish hue.

Rostrum with large mandibles, which are chelate, maxillary palpi with two distinct segments closely joined to the rostrum and a very small projection at the tip, which may represent a third segment. Each of the longer segments with a minute seta, and a longer seta on each maxilla; cephalo-thorax narrowed rapidly in front, the sides gently curved, the front margin with two long setae extending beyond the rostrum and placed closely together; near the caudo-lateral angles of the dorsum are also two long setae between which are two usually minute hairs; venter of cephalo-thorax with conspicuous epimera, the front epimera being united on the mesal line; between the first and second epimera on each side there is usually a small seta; first two pairs of legs thicker than the last two, 5-segmented, the tarsi of the first pair provided with spines and setae as follows: a large clavate sense organ, near the proxima lmargin on the dorsum, and a large heavy spine just distad of this; a much smaller clavate hair at one side of the larger sense organ, about half its length; between the larger clavate sense organ first mentioned and the spine distad of it is a smaller spine about one-third its length; at the tip of the tarsus above there is also a large spine with three setae surrounding it, one of which is much smaller than the rest; ventrad of the tarsal claw there are usually three or four heavy spines, grouped together and another proximad of these; there is a long seta near the proximal spine and a very inconspicuous one on the opposite surface of the tarsus; tarsal claw not sharply curved; tibia with a long seta on the dorsum near the distal end which is often as long or longer than the tarsal segment; there is a single stout spine on the caudal and ventral surface of this segment; the patella has two closely placed setae near the distal margin of the dorsum and the femur has a single long seta on the ventral surface; the second tarsus is essentially the same as the first, except that the smaller clavate hair or sense organ, and the small spine (between the larger hair and the spine immediately distad) are wanting; one seta is also lacking from the tip; the third and fourth pairs of legs lack the clavate sense organs and are different in the two sexes. In the female and normal male the third pair of legs are similar; there is a long thick spine at the tip of the tarsus, above and below which is a long slender seta; on the caudal surface of this segment there is also one seta and there is a spine on the opposite surface; the ventral surface has a spine shortly distad of the middle and a group of about four ventrad of the tarsal claw; the latter is sharply hooked. The third pair of legs of the dimorphic male are much thicker than the third pair of the female or normal male. There are four long setae at the tip, and the tarsal claw seems to be fused with the tarsal segment (Fig. 2, No. 10); the fourth pair of legs differ in the two sexes but are the same in dimorphic and normal males. In the female there is a distal spine on the tarsal segment just above the claw and one lateral (caudal surface) and one ventral spine in addition, besides a group of three just beneath the claw. There are usually three setae, one above and another below the distal spine and one lateral seta; in the male the distal dorsal spine is wanting, being replaced by a chitinous thickening sometimes called a sucker; proximad of this is still another thickening and between the two a single seta; the segment possesses the usual number of spines below the claw on lateral and ventral surfaces (Fig. 2, No. 7).

In the female the lateral surfaces of the abdomen are provided with about five setae on each side; the ventral surface with three minute setae on each side of the genital opening and one between the third and fourth coxae, a small one in front of and to one side of the third coxae and a long one on each side of the anal opening; the genital opening forms an inverted V-shaped figure with two genital suckers on each side (Fig. 3, No. 14); the dorsum has five setae on each side, of which the caudal pair are the longest.

In the male there are the usual five setae on lateral and caudolateral surfaces of the abdomen and one minute seta between the third and fourth pairs of legs on ventral surface, and a smaller one in front of and to one side of the third coxae; genital opening as in Fig. 3, No. 12 with two genital suckers on each side. Caudad of the genital opening are found two larger disc-like suckers, with a minute seta, caudad and cephalad, and usually a row of four longer ones caudad of the suckers; setae of the dorsum as in female.

Variations—There seems to be some variation both in the length of the setae of the legs and body and also in the thickness of the tarsal segments. Of seventeen individuals, however, measured with micrometer the ratio of width to length of tarsus IV ranged from 1-1.6 to 1-2.5, both sexes being examined. There is also a great variation in the depth of the depressions on the dorsum of the adult, they being almost obliterated in some individuals.

Length, female .47-.95 mm; male .5-.6 mm. Width, female .3-.4 mm; male .25-.3 mm.

Host Plants Infested and the Injury Resulting from the Infestation.

Narcissus (Plate I, b; II, a; III, b), hyacinth, tulip, crocus and Easter lily bulbs, are infested by the bulb mite. In the laboratory it has been reared on onions and potatoes, and is probably capable of subsisting on almost any tuber or bulb. Its common occurrence in narcissus and lily bulbs may be due to the fact that these bulbs offer least resistance to attack since the scales are loose and the mites find it easy to penetrate to the interior. Tulips are least injured, owing to their outer skin and tight-fitting scales which have no place for the mites to enter. Hyacinths seem to be less easy to penetrate than narcissus, while onions, artificially infested with mites, were not injured unless they were partly rotten or bruised in the beginning.

That the mites are able to feed on healthy tissue seems evident both from numerous references to this particular ability by various writers and from the experience of those connected with this office in the case of the Bermuda lilies already mentioned. A small

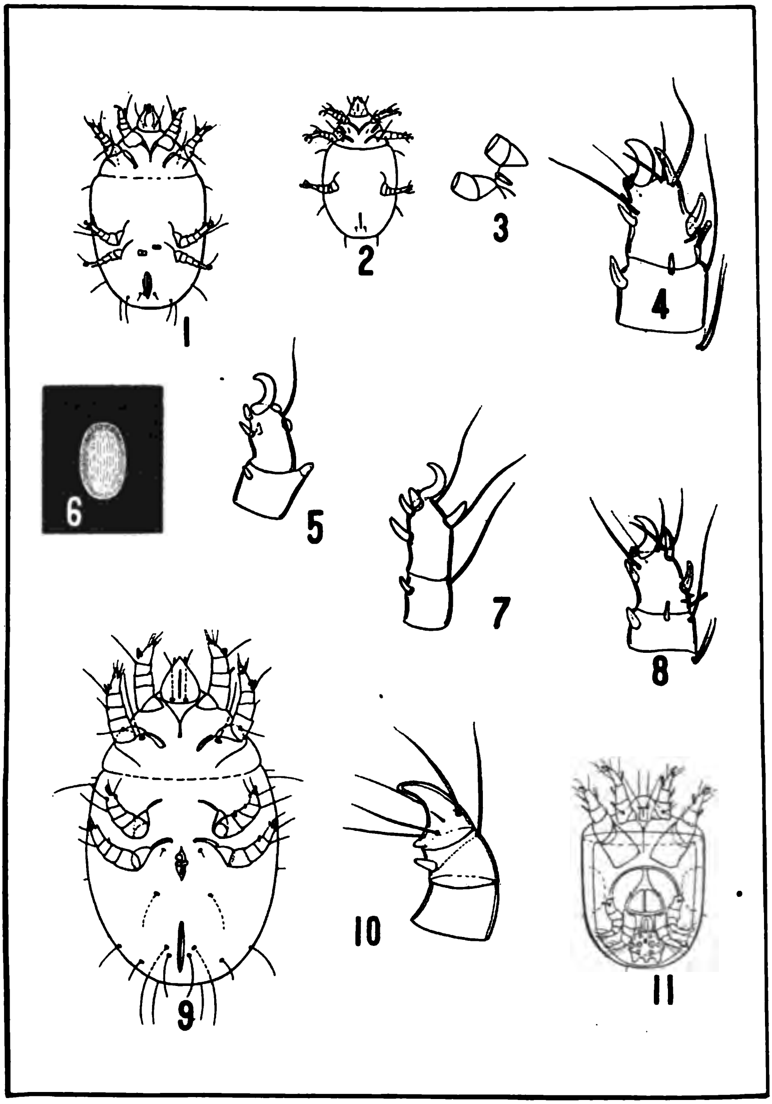

Figure 2. The bulb mite (*Rhizoglyphus hyacinthi* Banks). 1. Protonymph, enlarged about 80 times. 2. Larva, enlarged about 80 times. 3. Larva, sense organ of the ventral surface of the cephalothorax. 4. Front tibia and tarsus of the female. 5. Fourth tibia and tarsus of male. 6. Egg, enlarged about 80 times. 7. Fourth tibia and tarsus of the female. 8. Front tibia and tarsus of the female. 9. Tritonymph, enlarged about 80 times. 10. Fourth tibia and tarsus of dimorphic male. 11. Deutonymph or hypopus, enlarged about 80 times.

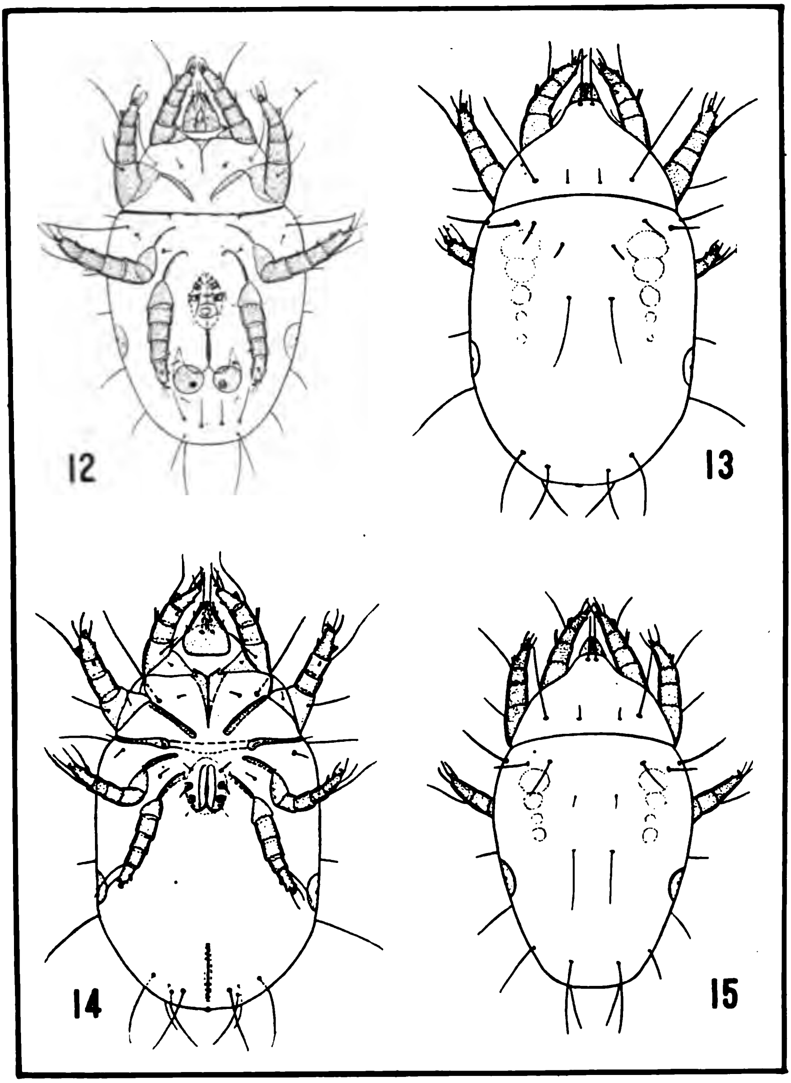

Figure 3. Adult bulb mite (*Rhizoglyphus hyacinthi* Banks), enlarged 80 times. 12. Male, ventral view. 13. Female, dorsal view. 14. Female, ventral view. 15. Male, dorsal view.

number of tests have been conducted by the writer in which mites entered and fed on growing narcissus bulbs. In these tests rotten bulbs containing mites were placed in pots of soil just below the healthy ones and the mites readily left the rotten and entered the healthy bulbs. Plate I, b, shows one of the infested bulbs.

Welsford[1] claims that the rot of narcissus bulbs is transmitted by the minute worm or nematode, *Tylenchus devastatrix**, and not at all by the mite, *Rhizoglyphus echinopus*. This worm, however, has not been found in many of the rotten bulbs examined, while in few cases have mites been absent from diseased examples. Welsford himself admits that the bulb mite does a great deal of damage, but he does not consider it equal in importance to the nematode as a carrier of disease.

LIFE HISTORY.

Few people in America seem to have studied the life history of the bulb mite. The most recent work is that of Yagi[2], a Japanese, who published a preliminary note on the life cycle in 1919. In this, he makes known the following facts: "The mite moults twice and the duration of one generation is about ten days in August, and twenty in June. Temperature is the chief factor in this variation and has an important effect on the embryonic development—the number of eggs laid by one female varied from 9-59, each being dropped singly on the surface of the bulb. The larva is sluggish and bores in the tissues of bulbs and grape vines. The adults mate within 2-8 hours after reaching maturity and oviposition begins on the day of mating. The life of the female is about two to four weeks in summer while that of the male is shorter."

Michael[3] reports one case in which he reared *echinopus* from egg to adult in 33 days. He observes three moults instead of two as noted by Yagi. Careful studies by the writer indicate that *hyacinthi* moults three instead of two times, thus confirming Michael's statement in this regard. When hypopi appear, however, four moults accur instead of three. The life period obtained at room temperature 60-75° F. (averaging about 68°) varied from 17 to 27 days; with temperature ranging from 70-80° F., 9-13 days. The mite becomes torpid at 50-55° F. and at about 95°. The air in which the mites lived during the time they were observed was kept as near optimum humidity as possible, which condition was judged largely by daily observance of the amount of moisture contained in the lens paper with which each cell was provided.

The period of incubation lasts from 4-7 days. A six-legged larva emerges from the egg and the mite lives in this condition 3 to 8 days. The last day or so of this period, sometimes two

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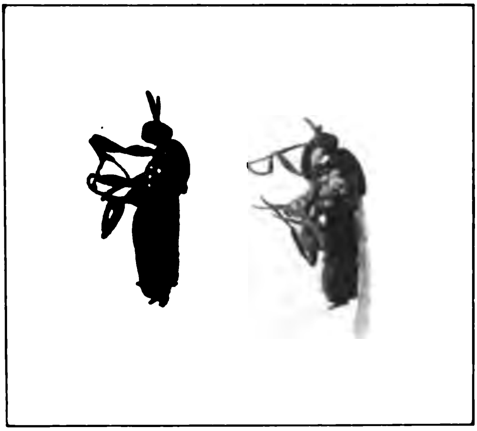
* Now *T. dipsaci* Kühn.

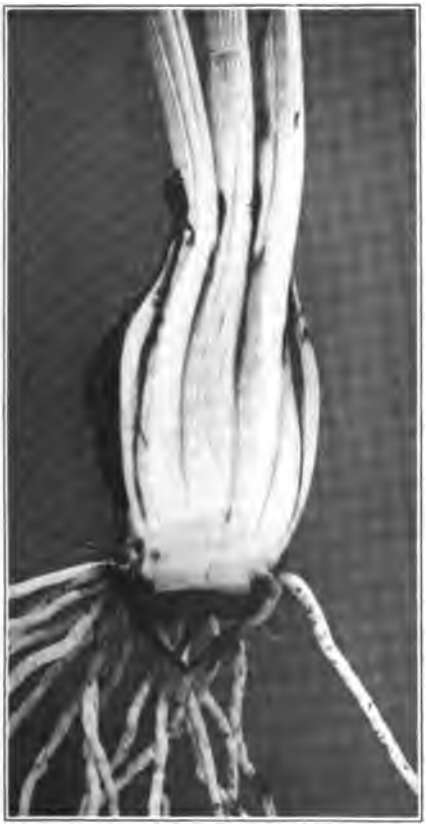
[1] Welsford, E. J. Investigation of bulb rot of narcissus. Ann. Appl. Biol. 82: 36-46: 1917.

[2] Yagi, N. Berichte Ohara Inst. Landwirtsch. Forschungen I: 349-360: 1918 Abstract in Rev. Appl. Ent., VII: 439-440: 1919.

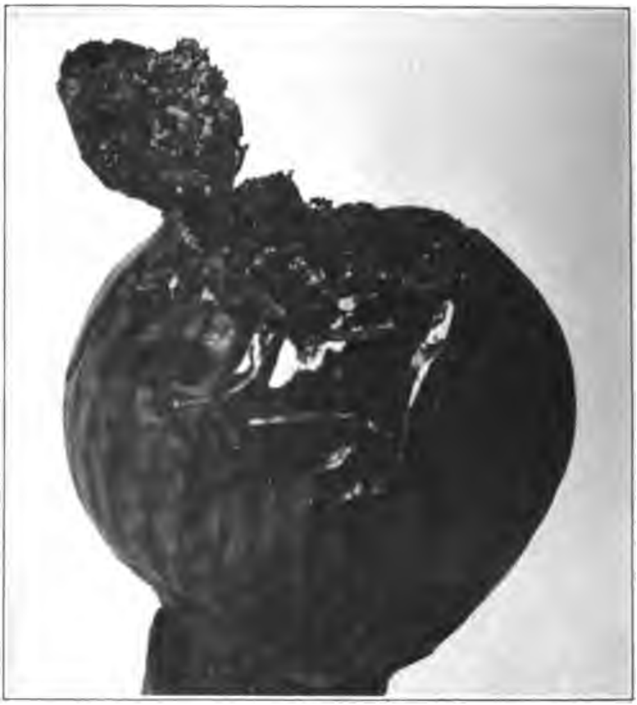
[3] Michael, A. D. British Tyroglyphidae. Vol. II: 92-93: 1903.



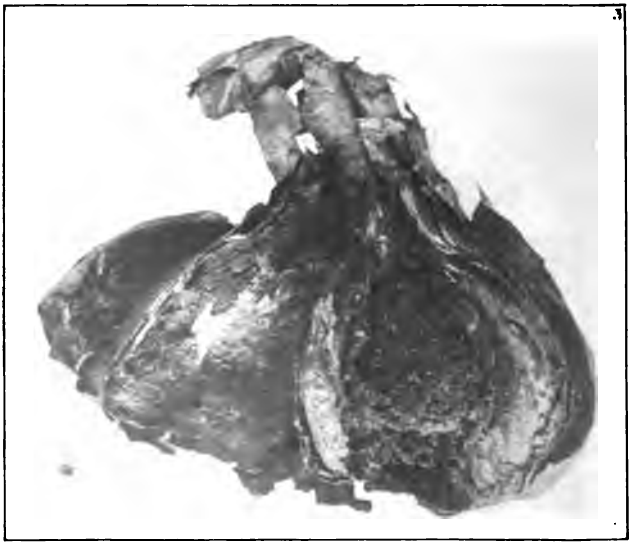
a. Flies, (*Scatopse pulicaria* Loew) with hypopi of the bulb mite clinging to them, enlarged 7 times.



b. Mite infestation just beginning in a growing bulb. Its progress is indicated by the dark lines between the scales, natural size.

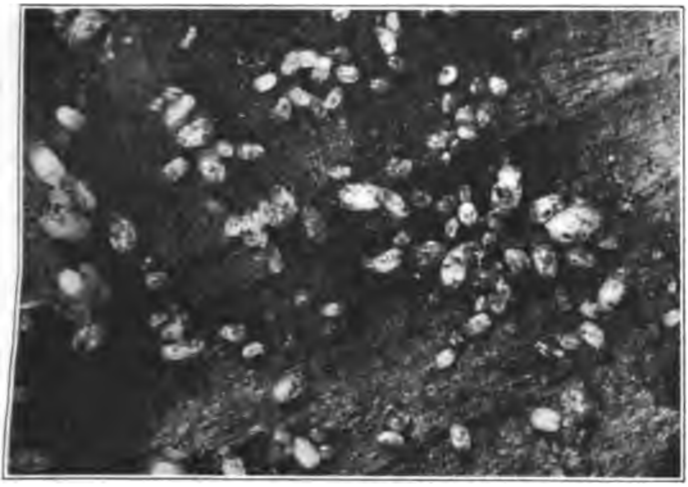


a. Rotten bulb with base removed showing mites, twice natural size.

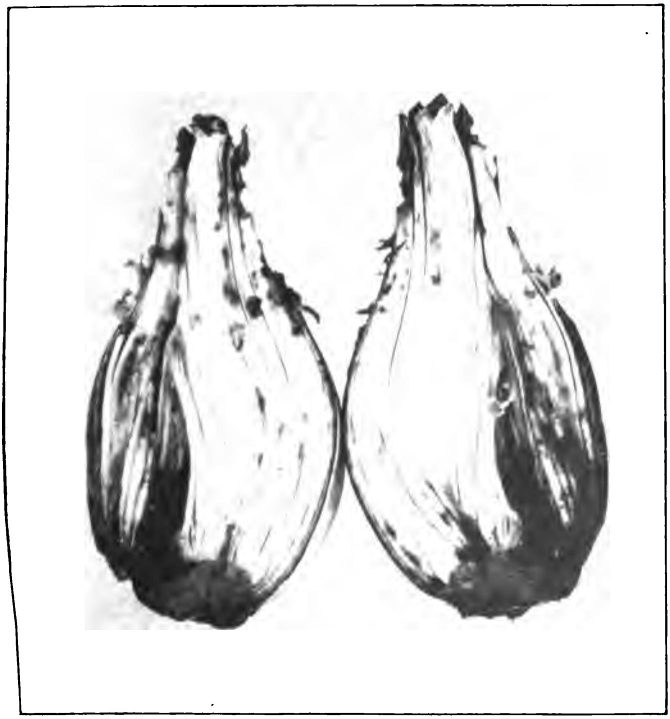


b. Bulb completely destroyed and containing a great many mites, natural size.

PLATE III.



a. Mites from a rotten bulb, enlarged 8 times.



b. Infestation just beginning in a healthy bulb, natural size.

days, is spent in a torpid or quiescent condition and at this time the larva swells so that the separating line between the thorax and abdomen is lost. On moulting the larva acquires two additional legs, making eight in all. The next period, which may be known as the protonymph* lasts two to four days, after which follows a second quiescent period of about two days and a second moult takes place. This time there is no increase in the number of legs or much change in form unless a hypopus or resting stage is produced. If normal in form the mite, now known as the tritonymph*, again goes into the quiescent state which lasts 1-2 days; and moults. The adult mite then emerges. If, however, the hypopial state appears after the second moult, the mite may rest for one or two weeks or more, afterwards moulting and giving rise to the tritonymph. The latter then moults and the adult mite emerges as before.

Adults mate a day or so after becoming mature and the eggs are soon laid, beginning with a few daily at first and later increasing in number up to six or eight. Two females observed laid ten eggs per day for four successive days, but this is rather unusual. The number of eggs laid has been found to vary considerably, some females laying more than one hundred, others laying only a few. One individual laid 130 eggs in all, while one other laid 81, and still another 59. The males usually die shortly after mating, but if kept separate have been observed at this laboratory to live for more than two months. Females also live from one to two months or more if properly fed and cared for.

The following shows the course of the life history:

Cycle in which hypopial stage is skipped.

Egg—larva—first nymph—third nymph—adult female.
Egg—larva—first nymph—third nymph—dimorphic male adult,
normal male adult.

Cycle with hypopial stage.

Egg—larva—first nymph—hypopus—third nymph—adult female.
Egg—larva—first nymph—hypopus—third nymph—dimorphic male adult,
normal male adult.

THE DIMORPHIC OR HETEROMORPHIC MALE.

The dimorphic male with enlarged third pair of legs (Fig. 2, No. 10) has been thought by some to be a distinct species, but it has been definitely proven by others to be merely a form of more or less infrequent occurrence. In one lot of mites examined 36 males were seen without encountering a single dimorphic form. In other lots the males with and without enlarged legs appeared in about equal numbers. The dimorphic males breed freely and the offspring consists of both females and normal and heteromorphic males. One specimen was seen with an enlarged third leg on one side and a leg of normal size on the other. The exact function of the dimorphic male is not clearly understood, nor do we understand the causes which bring about such remarkable differences in this sex.

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* The hypopus is regarded as the deutonymph, and is frequently interpolated between protonymph and tritonymph.

THE HYPOPUS.

Rather complete studies of the hypopus of *echinopus* have been made by Michael and other European authorities, and it is now regarded as a normal period in the life history of the mite. Briefly explained, it is a form similar to some of its ancestors which is produced from time to time from no apparent reason other than a strong tendency to revert to type and "is a provision of nature for the distribution of the species occurring irrespective of adverse conditions[1]". Notwithstanding, the fact remains that is often impossible to distinguish between favorable and unfavorable conditions and it seems certain that conditions promoting their development are not always at hand. The following notes relate to the development of the hypopus.

First of all it has appeared that hypopi are much more numerous in jars where the bulbs are rotted enough to leave them in a wet, sticky condition. Hypopi are produced in dry as well as moist cells, but more rapidly and frequently more abundantly in the moist cells. This was demonstrated by use of a moisture gradient consisting of four hanging drop slides with small cells, clamped to a larger piece of glass and with a sheet of lens paper between; one end of the gradient being placed in moist sand, and each cell provided with a single pair of mites and the necessary food. The following shows the results of three tests with the gradient described. Cell No. 1 in each case was in contact with moist sand, 2, 3 and 4 further away in the order mentioned. These tests were then repeated with similar results.

No. of cell.	No. of mites.	Per cent. of hypopi.	Food used.	Date	
				Begun.	Examined.
1	111	27	Unfermented dry narcissus.	May 14	July 7
3	83	7	“	“ “	“ “
4	90	0	“	“ “	“ “
2	39	82	Fermented hyacinth.	“ “	“ “
3	14	50	“	“ “	“ “
4	105	0	“	“ “	“ “
1	213	25	Fresh narcissus.	July 24	Sept. 9
2	60	10	“	“ “	“ “
3	21	0	“	“ “	“ “
4	60	0	“	“ “	“ “

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[1] Michael, A. D. The hypopus question, or the life-history of certain Acarina. Jour. Linn. Soc., Zool., XVII; 389; 1884.

On April first a small tightly corked bottle was providéd with about an inch of moist sand and a number of slices of potato previously infested with the bulb mite. These mites did not multiply rapidly but reproduced fairly well and on June 8, 100 individuals were counted without encountering a single hypopus. Little or no fermentation took place in the bottle until after this date and most of the eggs were laid on the outside of the potato and were fairly dry. However, where the potatoes were in contact with the sand there was considerable moisture surrounding the developing mites. Only one hypopus was seen in the bottle until July 1. During the latter part of July mold obtained a foothold on the potato but the mites continued to breed, many of them being covered with a wet sticky film. However, even under such conditions less than one per cent. of hypopi developed—as was seen by examination on September 9. In order to test the natural ability of the strain on potato to produce hypopi, mites were transferred to glass cells with narcissus or hyacinth at several different periods during the course of the experiment. Hypopi were produced abundantly in practically every case the percentage varying from 10 to 80%. In this bottle and five other similar ones made from it hypopi did not begin to appear in numbers until about October 25, making a period of some six months when they did not develop. It is difficult to explain the appearance of the hypopus in small cell transfers, but it seems as if some necessary change in conditions must have taken place.

Hypopi developed in light and dark, when fed on decayed and sound food, in moist and dry cells and apparently when warm and cold. They also developed about equally well when the food was covered with small amounts of sugar, alcohol (2%) and acetic acid (1%).

Michael used many experiments to try to induce certain species of Tyroglyphids to develop without producing hypopi, but failed; and he concluded that hypopus is a normal stage in their development. Notwithstanding, in the case of mites like the bulb mite in which all individuals do not pass through the hypopus stage, it seems hazardous to ascribe such a phenomenon entirely to the inherent atavistic tendency or natural habit of the individuals. It is well known that in a somewhat similar life cycle found in aphids, reversion to the sexual forms which are more commonly skipped are induced largely by changes of weather and food. Some species of aphids, moreover, may be reared continuously without reversion, when proper conditions of moisture, temperture, etc., are maintained, and it seems as if something similar must be true of the mites under investigation, caused by factors which we have not yet learned to recognize.

The length of the hypopus stage under favorable conditions is usually about one to two weeks.

MIGRATION OF THE SPECIES.

The hypopus is much more active than the remaining stages in the life cycle of the mite, and has a tendency to wander from place to place. It will also attach itself to any moving object. At the time when hypopi become numerous, the bulbs are commonly well rotted and infested by numerous small fly larvae, one of which (*Scatopse pulicaria* Loew) (Plate I, a) was found in large numbers. The flies of this species were frequently found to be literally covered with hypopi attached by means of their ventral suckers. Other hypopi were seen riding peacefully on the backs of predaceous mites, and still others have been found attached to lepidopterous larvae. The mite is thus afforded an admirable means of transportation, of which it is capable of taking full advantage because of its structure and habits.

The tables below show the length of the various stages as determined at this laboratory.

TABULAR LIFE HISTORY OF THE BULB MITE

LENGTH OF EGG STAGE.

Length of stage days.	Number observed.	Dates.
		1919.
	Temperature 60°-75° F.	
7	8	Sept. 29-Oct. 6.
6½	3	Oct. 10-Oct. 17.
7	4	Oct. 10-Oct. 17.
6½	4	Oct. 10-Oct. 17.
		1920.
	Temperature 70°-80° F.	
4	2	July 15-July 19.
3	2	July 16-July 19.
4	3	July 16-July 20.
4	8	July 16-July 20.

LENGTH OF LARVAL STAGE.

Length of stage days.	Number observed.	Dates.
		1919.
	Temperature 60°-75° F.	
8	1	Oct. 3-Oct. 10.
6	1	Oct. 6-Oct. 11.
7	2	Oct. 6-Oct. 12.
6	2	Oct. 17-Oct. 21.
6	1	Oct. 17-Oct. 22.
6	2	Oct. 17-Oct. 22.
6½	2	Oct. 16-Oct. 21.
		1920.
	Temperature 70°-80° F.	
2	2	July 19-July 21.
3	8	July 20-July 23.
3	2	July 18-July 21.
4	1	July 19-July 23.
5	3	July 19-July 24.

LENGTH OF FIRST NYMPHAL STAGE (PROTONYMPH).

Length of stage days.	Number observed.	Dates.
		1919.
Temperature 60°-75° F.		
3	1	Nov. 10-Nov. 13.
3	1	Nov. 12-Nov. 15.
4	1	Nov. 11-Nov. 15.
3	1	Nov. 8-Nov. 11.
4	1	Nov. 8-Nov. 12.
8	1	Nov. 16-Nov. 24.
5	1	Nov. 19-Nov. 24.
3	1	Nov. 20-Nov. 23.
2	1	Nov. 20-Nov. 22.
		1920.
Temperature 70°-80° F.		
2	1	July 21-July 23.
2	1	July 21-July 23.
2	1	July 21-July 23.
1	2	July 21-July 22.
2	2	July 21-July 23.

LENGTH OF HYPOPUS STAGE (DEUTONYMPH).

Length of stage days.	Number observed.	Dates.
		1920.
Temperature 65°-75° F.		
12	1	March 15-March 27.
7	1	March 29-April 5.
5	1	April 17-April 22.
7	1	April 10-April 17.
13	1	April 10-April 23.

LENGTH OF THIRD NYMPHAL STAGE (TRITONYMPH).

Length of stage days.	Number observed.	Dates.
		1919.
Temperature 60°-75° F.		
4	1	Nov. 15-Nov. 19.
3	1	Nov. 11-Nov. 14.
4	1	Nov. 12-Nov. 16.
3	1	Nov. 24-Nov. 27.
3	1	Nov. 23-Nov. 26.
4	1	Nov. 22-Nov. 26.
		1920.
Temperature 70°-80° F.		
3	1	July 23-July 26.
3	1	July 24-July 27.
2	1	July 25-July 27.
3	1	July 24-July 27.
2	1	July 23-July 25.
2	2	July 22-July 24.
2	1	July 23-July 25.

Variations obtained in length of life cycle 9-29 days (with hypopus absent from the cycle); with hypopus included 14-42 days.

Other Species of Mites and Predaceous Enemies.

Several predaceous mites (Parasitidae) and the Tyroglyphid, *Histiostoma rostro-serratus* have been found frequently, but the

TESTS OF VARIOUS OILS.

Insecticide used.	Strength of material used.	Length of exposure.	Number alive.	Number dead.	Per cent. killed	Dates. 1919.	Notes.
Fir tree oil*	1 pt.**—320 pts. water	2 min.	23	143	86.1	10/17	All stages included.
Scalecide	1 pt.—25 pts. water	2 min.	400	3	.7	10/17	" " "
"	1 pt.—15 pts. water	10 min.	500	0	0	11/20	" " "
Lemon oil	1 pt.—100 pts. water	½ hr.	149	1	.6		
" "	1 pt.—10 pts. water	½ hr.	10	0	0		Hypopi only.
" "	1 pt.—25 pts. water	2 hrs.	48	2	4.0	12/13	" "
Schnarr's Insecticide	1 pt.—100 pts. water	2 min.	100	0	0	10/17	
" "	1 pt.—50 pts. water	10 min.	200	2	.9	11/20	
Check (soaked in tap water)		10 min.	135	5	3.5	11/20	

TESTS OF FUMIGANTS.

Carbon disulphide	1 oz.—100 cu. ft.	24 hrs.			50	11/17	Room temperature.
" "	1 oz.—100 cu. ft.	48 hrs.	4	106	96.0	11/20-22	" "
" "	1 oz.—100 cu. ft.	48 hrs.	36	11	23.4	11/20-22	Room temperature; hypopi only.

TESTS OF HEAT, NICOTINE, FORMALIN AND COMBINATIONS THEREOF.

Insecticide used.	Strength of Insecticide.	Length of exposure.	Number alive.	Number dead.	Per cent. killed	Dates 1919.	Notes.
Heat	70° C.	1 hr.	0	200	100	11/30	Mites put in stoppered bottles and heated in an oven with gas. All hypopi and mites on interior of bulb were dead at end of period.
"	49° C.	1 hr.	98	2	2	12/2	
"	49° C.	1 hr.	8	2	20	12/2	

---

* This insecticide is now difficult to obtain on the market.
** Pt. equals part.

Hot water	50° C.		1 hr.	0	140	100	12/2	No hypopi seen.
" "	50° C.		10 min.	0	100	100	12/3	" " "
" "	50° C.		10 min.	8	2	20	12/3	Hypopi only.
" "	55° C.		10 min.	0	50	100	12/16	
" "	55° C.		10 min.	0	10	100	12/16	Hypopi only.
" "	60° C.		10 min.	0	200	100	12/5	Temperature fell from 60° at beginning to 52° at end of period.
" "	60° C.		20 min.	0	200	100		Hypopi and all mites on interior of bulb were killed.
40% Formalin	50° C.	1-20 (2%)	2 min.	16	38	70.3	12/23	Hypopi and normal mites observed alive.
40% "	50° C.	1-20 (2%)	10 min.	0	32	100	12/23	Hypopi only.
Nicotine sulphate	R*	1-800	2 min.	500	50	9.0	11/17	Some of mites on interior of bulb were dead.
Nicotine sulphate and soap	R	1-400 soap 2 lbs. 50 gals.	10 min.	64	11	14.6	11/20	
Nicotine sulphate and soap	R	" " "	24 hrs.	221	17	7.1	11/20	
							1920.	
Nicotine sulphate	51° C.	1-400	5 min.	0	110	100	1/17	Hypopi only.
" "	50° C.	1-400	10 min.	10	131	92.9	11/26	No hypopi. Many mites on interior of bulb killed.
Nicotine oleate	R	Moore's** formula	10 min.	2	14	87.5	1/14	Very few hypopi.
Nicotine oleate	50° C.	Moore's formula	5 min.	2	48	96	1/14	Hypopi only.
" "	50° C.	" "	5 min.	0	50	100	1/14	Normal mites only.
" "	50° C.	½ strength of above.	5 min.	0	21	100	1/15	Hypopi only.
" "	50° C.	Same as above.	5 min.	0	100	100	1/15	Normal mites.
Check (no treatment)				60	0	0	1/19	Hypopi only counted.

---

*R = room temperature. Tap water used at about 20° C.

**Nicotine oleate made by combining 10 parts kerosene with 1¼ parts commercial oleic acid, and then 2½ parts of 40% nicotine solution. 10 parts of water were added and the whole quantity then mixed with 480 parts of tap water. See Jour. Econ. Ent. XI: 342, 1918. The oleic acid from which nicotine oleate is prepared is difficult to obtain.

latter seems to flourish best in wet rotten bulbs and has not been observed to feed on healthy tissue. The small hypopus of this species is produced abundantly and frequently attaches itself to *Rhizoglyphus* or any insect which lives within the bulbs. *Histiostoma* is much smaller than *Rhizoglyphus* as is also the hypopus, compared with that of the bulb mite. When observed feeding the adult is much lighter in color and the caudal margins of the abdomen are less rounded. The predaceous species (Laelaptini) are very active brown mites slightly larger than the true bulb mite. In one box of bulbs containing about one-fourth bushel, these enemies became very numerous and were seen running about over the bulbs like ants. Doubtless they had destroyed many bulb mites. In another case a Mason jar containing many bulb mites was entirely cleared of *Rhizoglyphus* in about a month after the predaceous species was first noticed in the jar.

The small Cecidomyid fly *Lestodiplosis* sp.* was also found feeding upon the bulb mite. The larva is a small, pinkish maggot about one mm. in length, which crawls about among the mites and feeds on them.

CONTROL MEASURES.

Morphological studies show that the mite has no tracheal system and cannot be killed, theoretically, by ordinary fumigants. Ewing[1] demonstrated that 4.1 oz. of potassium cyanide per 5470 cu. ft. or 1 oz. per 133 cu. ft. of air space was insufficient to kill the bulb mite. Fumigation at this laboratory with carbon disulphide in an air tight container, 1 oz. to 100 cu. ft. required 48 hours to obtain a good kill. Mites on the interior of the bulbs were not killed even with this length of exposure. Sorauer[2] recommends for use against the mite, *R. echinopus*, the use of a 48 hour carbon disulphide fumigation or immersion in tobacco extract. 40% nicotine sulphate 1-400 with the addition of soap killed only 7.1% in tests conducted here. Fir tree oil was considerably more efficient, killing 60-90% in some instances, while in bulbs soaked in water heated to 55° C. nearly 100% were killed. Woods[3] treated bulbs with mercuric chloride 1-1000 and 1-2000, formalin 1-1000 and 1-2000 without success. A good kill, however, was obtained by the writer with formalin heated to 50° C. (122° F.), the bulbs being left for a period of ten minutes. Nicotine sulphate 1-400 heated to 50° C. (122° F.) and nicotine oleate heated to 50° were also very successful acaricides.

In all cases careful observations were made on the hypopus because of its greater resistance, and the mites were examined daily for three days after treatment to be sure of results.

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* Determined by Dr. E. P. Felt.

[1] Ewing, H. E. Oregon Agr. Exp. Sta. Bul. 121: 70: 1914.

[2] Sorauer P. Pflanzenkrankheiten III: 109: 1913.

[3] Woods, A. F. U. S. Dep. Agr., Div. Veg. Phy. & Path., Bul. 14: 1897.

For convenience, the different treatments and practices for control of the pest, will be enumerated.

UNSUCCESSFUL TREATMENTS.

1. Hydrocyanic acid gas (HCN) fumigation, the gas obtained by using potassium cyanide 1 oz. to 133 cu. feet of air space[1].
2. Carbon disulphide 1 oz.-100 cu. feet—24 hr. fumigation.
3. Formalin 1 part-1000 parts water and 1 part-2000 parts water—cold[2].
4. Nicotine sulphate 1 part-400 parts water plus soap 2 lbs.-50 gals.—cold.
5. Schnarr's insecticide 1 part-100 parts water.
6. Scalecide 1 part-15 parts water.
7. Mecuric chloride 1 part-1000 parts water and 1 part-2000 parts water[2].

PARTLY OR ENTIRELY SUCCESSFUL TREATMENTS.

1. Carbon disulphide 1 oz.-100 cu. feet—48 hour fumigation.
2. Nicotine sulphate 1-400 heated to 50° C. (122° F.)—bulbs immersed for 10 min. Also nicotine oleate at the same temperature.
3. Formalin (2%) heated to 50° C; bulbs immersed for 10 minutes.
4. Hot water 55° C. (131° F.)—bulbs immersed for 10 minutes.

PRACTICES OF VALUE IN GETTING RID OF THE MITE.

1. Selection of bulbs to be planted; all soft and rotten bulbs to be discarded.
2. Proper care and fertilization of the growing plants.
3. Cold storage 33-35° F. (any temperature below 50° F.) to prevent multiplication of the mites while stored.

TESTS OF TREATMENTS FOR NARCISSUS BULBS TO DETERMINE WHAT INJURY IF ANY RESULTS THEREFROM.

Insecticide Used	Temperature of Insecticide	Period of Treatment	Date of Treatment	Amount of Injury	Date of Examination	No. of bulbs per Treatment
Nicotine Sulphate 1-400 Soap (2 lbs.—50 gals.)	50° C.	10 min.	1920 Aug. 31	None	1920 Nov. 28	10
Nicotine Sulphate 1-400 Soap (2 lbs.—50 gals.)	50° C.	5 min.	Aug. 31	None	Nov. 28	10
Formalin 2%	50° C.	10 min.	Aug. 31	None	Nov. 28	10
Nicotine Sulphate 1–400	50° C.	10 min.	Aug. 31	None	Nov. 28	10
Nicotine Sulphate 1-400 Soap (2 lbs.—50 gals.)	45° C.	10 min.	Aug. 31	None	Nov. 28	9
Nicotine Sulphate 1-400 Soap (2 lbs.—50 gals.)	45° C.	5 min.	Aug. 31	None	Nov. 28	10
Check, no treatment	....	....	Aug. 31	None	Nov. 28	10

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[1] Ewing, H. E. Oregon Agr. Exp. Sta., Bul. 121: 70: 1914.
[2] Woods, A. F. U. S. Dep. Agr., Div. Veg. Phys. and Path., Bul. 14: 1897.

A few tests were conducted with narcissus bulbs in order to be sure that no injury results from the more successful treatments. Ten narcissus bulbs were first heated to 59-65° C. in hot water and left for a period of one-half hour. Two bulbs were retained as checks. All treated bulbs were killed, but the checks remained healthy and grew. Shortly after, two narcissus bulbs were treated with hot water at a temperature of 50° C. for ten minutes. These bulbs had fresh roots about one inch in length. Two bulbs were retained as checks. All bulbs grew, but the untreated were seen to be in better condition at time of blooming and on removing from the pots, the original roots of the treated were found to be dead and a new lot in their place. The table above is a continuation of these tests and shows that a temperature of 50° C. is non-injurious to narcissus, if the bulbs are without fresh roots and the period of immersion is not great.

Paper white narcissus were used in these tests and none of the bulbs had any fresh roots. Some of the treated bulbs grew better and were more vigorous than the checks. All bulbs grew and the plants were approximately the same height at the conclusion of the test.

CONCLUSIONS.

1. The bulb mite is capable of injuring healthy growing bulbs.
2. It is spread from place to place chiefly by means of the hypopus, which clings to small flies emerging from the decayed bulbs.
3. The life cycle may be completed in less than a month (9-29 days), or may be extended to a month and a half if the hypopial stage develops or if adverse conditions prevail.
4. One of the most satisfactory means of killing the mites was found to be that of dipping the bulbs in nicotine sulphate 1-400 or nicotine oleate, heated to 50° C. Hot water (50° C.) also kills a good percentage.
5. The authority commonly given for the scientific name should be changed to Banks and the name should read *Rhizoglyphus hyacinthi* Banks.

TWENTIETH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

FOR THE YEAR 1920

(Being Bulletin 226 Connecticut Agricultural Experiment Station)

BY

W. E. BRITTON, PH. D.
State Entomologist

NEW HAVEN, CONN.
1921

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NOTE REGARDING AUTHORSHIP.

For bibliographical purposes, all matter in this Report (Bulletin 226) except where otherwise indicated, should be credited to W. E. Britton.

BULLETIN 226

TWENTIETH REPORT

OF THE

State Entomologist of Connecticut

To the Director and Board of Control of the Connecticut Agricultural Experiment Station:

I transmit, herewith, my twentieth report as State Entomologist of Connecticut, covering the activities of the year of 1920. The financial statements are for the state fiscal year ending June 30, 1920. This report contains an account of the various lines of work placed upon the office by Statute such as inspecting nurseries and apiaries, and suppressing the gipsy moth, and articles dealing with the mosquito work of the year, the European red mite and the apple and thorn skeletonizer, two new orchard pests, life history notes on the false apple red bug, a sawfly feeding upon Austrian pine and miscellaneous notes on various economic insects.

Respectfully submitted,

W. E. Britton,
State and Station Entomologist.

Report of the Receipts and Expenditures of the State Entomologist from July 1, 1919, to June 30, 1920.

Receipts.

From E. H. Jenkins, Treasurer	$7,500.00	
Account of 1919, Balance	1,889.75	
State Comptroller, Gipsy Moth Account	729.21	
M. P. Zappe, Automobile Mileage	10.68	
W. E. Britton, Automobile Mileage	5.10	
Interest on Bank Deposits	40.06	
Sale of old paper	3.45	
		$10,178.25

Expenditures.

For Field, Office and Laboratory Assistance:	
B. H. Walden,* salary	$1,499.97
M. P. Zappe, salary	1,750.00
Philip Garman, salary	1,666.62
K. F. Chamberlain,† salary	800.00

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*For nine months: remainder paid from mosquito appropriation.

†For eight months: resigned March 1, 1920.

Gladys M. Finley, salary	$704.00		
George D. Stone, salary	359.78		
Other assistance	217.60		
		$6,997.97	
Printing and Illustrations		36.10	
Postage		80.46	
Stationery		21.69	
Telegraph and Telephone		1.80	
Office Supplies		82.24	
Library		183.46	
Laboratory Supplies		611.65	
Express, Freight and Cartage		26.40	
Rental and Storage		1.45	
Traveling Expenses		719.23	
Insurance		65.85	
Automobile tires and repairs		499.51	
Balance, Cash on Hand		850.44	
			$10,178.25

Memorandum:—This account of the State Entomologist has been audited by the State Auditors of Public Accounts. The item of $729.21, credited as having been received from the State Comptroller is really a transfer from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock, and covers the time and automobile mileage of members of the department staff while engaged in inspecting imported nursery stock.

SUMMARY OF INSPECTION AND OFFICE WORK.

256 samples of insects received for identification.
95 nurseries inspected.
92 regular certificates granted.
35 parcels of nursery stock inspected and certified.
65 orchards and gardens examined.
17 shipments, containing 87 cases, 814,491 plants imported nursery stock inspected.
11 shipments, or 64 per cent. found infested with insects or fungi.
762 apiaries, containing 4,797 colonies, inspected.
33 apiaries, containing 72 colonies, found infested with European foul brood.
9 apiaries, containing 12 colonies, found infested with American foul brood.
2,576 letters written on official work.
646 circular letters.
454 post cards.
17 reports of inspection to Federal Horticultural Board.
1,007 bulletins, etc., mailed on request or to answer inquiries.
66 packages, sent by mail or express.
25 lectures and addresses at institutes, granges, etc.

PUBLICATIONS OF ENTOMOLOGICAL DEPARTMENT, 1920.

By W. E. Britton:

Nineteenth Report of the State Entomologist (Bulletin 218), 100 pages, 5 figures, 24 plates, 10,500 copies distributed in May, 1920.

Insects Attacking Squash, Cucumber and Allied Plants in Connecticut (Bulletin 216), 21 pages, 9 figures, 8 plates; 10,000 copies distributed in February, 1920.

Report of Committee on Injurious Insects, Report of Connecticut Vegetable Growers' Association for 1919, page 51, 1920.

Report of Committee on Injurious Insects, Proceedings Twenty-Eighth Annual Meeting Connecticut Pomological Society, page 15, 1920.
Some Phases of Beekeeping in Connecticut, Journal of Economic Entomology, Vol. 13, page 91, February, 1920.
A Connecticut Cornfield Injured by *Crambus præfectellus* Zinck, Journal of Economic Entomology, Vol. 13, page 222, April, 1920.
More About the Cyclamen Mite, Florists' Exchange, Vol. XLIX, page 285, February 7, 1920.

DEPARTMENT STAFF AND WORK.

W. E. BRITTON, PH.D., *State and Station Entomologist.*
B. H. WALDEN, B.AGR., *Photographic and General Work.*
IRVING W. DAVIS, B.SC.* *Deputy in Charge of Moth Work.*
M. P. ZAPPE, B.S., *Inspection and General Work.*
KENYON F. CHAMBERLAIN,† *Inspection and General Work.*
PHILIP GARMAN, PH.D., *Research Work.*
JOHN T. ASHWORTH,‡ *Acting Deputy in Charge of Moth Work.*
SAMUEL T. SEALY,§ *Deputy in Charge of Mosquito Work.*
} *Assistant Entomologists.*
MISS GLADYS M. FINLEY, *Clerk and Stenographer.*

H. W. COLBY, Westport,
A. W. YATES, Hartford,
} *Apiary Inspectors.*

There have been a few changes in the department staff during the year. Mr. Chamberlain resigned March 1, after a year's service. Mr. Davis, who for nearly seven years has been in charge of the work of suppressing the gipsy and brown-tail moths, resigned June 10 to accept a position with the Danielson Trust Company, of Danielson. Mr. Davis was very successful in his work and it was with much regret that we accepted his resignation. Mr. Ashworth has been placed temporarily in charge of the gipsy moth work.

Mr. Sealy was appointed deputy to the Director in charge of mosquito drainage work and began his duties April 19. Mr. Sealy formerly was employed in this kind of work by the Nassau County, N. Y., Mosquito Extermination Association.

Mr. Walden, who has been in charge of mosquito work for about four years, has this season been engaged in photographic work, inspection, and general work, and has been in charge of the department in the absence of the Entomologist. He has made photographic illustrations for the plates of the Connecticut Hemiptera and has collected an excellent series of leafhoppers from various hosts in different parts of the state.

Mr. Zappe has been in charge of the inspection of nurseries and of imported nursery stock. He has also aided in some orchard spraying and dusting experiments, and has studied the life histories of the false apple red bug, a leafhopper on apple, and a sawfly, (*Itycorsia zappei* Rohwer) feeding on Austrian pine.

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*Resigned June 10.
†Resigned March 1.
‡Beginning June 10.
§Beginning April 19.

Dr. Garman has been engaged in studying the life history of the bulb mite, the results of which have been published as Bulletin No. 225. He has also commenced an interesting study of the life history of the frog hoppers or spittle insects (family Cercopidae) and is also at work on the mites of Connecticut and the Odonata or dragonflies of Connecticut, the results of which will be published by the Geological and Natural History Survey of the State.

The Entomologist has spent considerable time in revising manuscript and reading proof on the Check List of the Insects of Connecticut, which has appeared as Bulletin 31 of the Geological and Natural History Survey, and in editing and writing a portion of the manuscript of the Hemiptera of Connecticut which will also be published as a later bulletin of the Survey.

Miss Finley has continued as clerk and stenographer, and during a part of May when on her vacation, the necessary work was done by a substitute, Miss Marion D. Pickett.

Messrs. Coley and Yates as heretofore have inspected the apiaries, working by the day.

From August 7 to September 11, Mr. Edward R. Barton and Mr. F. D. Luddington were employed to assist in inspecting nurseries.

All members of the staff have rendered efficient and faithful services.

INSPECTION OF NURSERIES.

Mr. Zappe was placed in charge of this work and began on August 5. There was much rainy weather and the spraying and dusting experiments required that the dropped fruit be scored, as well as the picked fruit later. The work somewhat interfered with the inspection of nurseries. Nevertheless all was finished on October 18. Messrs. Zappe and Walden did most of this inspection work but were assisted at times by Messrs. Garman, Britton and Sealy, and Mr. F. D. Luddington and Mr. E. R. Barton were employed from August 7 to September 11, and helped inspect the larger nurseries. No one from the gipsy moth force was pressed into service inspecting nurseries, except that Mr. Ashworth helped the Entomologist inspect two nurseries in Windham County on September 2.

The same system of inspection in vogue in preceding years was continued in 1920, and most of the inspection trips were made in the department automobile.

In 46 nurseries no pests were found.

The principal pests, with the number of nurseries infested by each are as follows:

Insects:—Oyster-shell scale 38; San José scale 11; Scurfy scale 7; pine leaf scale 7; tulip tree scale 3; rose scale 2; spruce gall aphid 21; *Chermes cooleyi* 2; green apple aphid 2; woolly apple aphid 2; elm scale, euonymus scale, pine weevil, lilac borer, peach borer and Rhododendron lace bug, one each.

Plant Diseases:—Poplar canker 13; fire blight 6; crown gall 1.

On the whole about the same pests were found as last year though the oyster-shell scale and the San José scale were not present in as many nurseries, and 46 nurseries were found uninfested as against 32 last year.

Two new nurseries started in the spring and were inspected then and again inspected in the fall. These are marked (2) after the name on the list. Five nurseries have gone out of business, two have changed in name, and eight new ones have started during the year. Five old ones did not clean out the infested stock in time to obtain certificates and consequently were not on the list last year. Two nurseries have not cleaned out the infested stock, this year, and consequently have not received certificates.

Thirty-five separate parcels of nursery stock have been inspected and certificates granted.

The list for the season contains 90 names as follows:

Nursery Firms in Connecticut Receiving Certificates in 1920.

Name of Firm	Address.	Acreage.	Certificate Issued.	No. of Certificate.
Barnes Bros. Nursery Co.	Yalesville	150	Sept. 23	1115
Barnes Nursery & Orchard Co.	Wallingford	12	Aug. 30	1073
Beattie, Wm. H.	New Haven	1	Sept. 13	1091
Bertolf Bros.	Sound Beach	25	Sept. 18	1106
Brainard Nursery & Seed Co.	Thompsonville	6	Sept. 15	1094
Braley & Co.	Burnside	1	Sept. 17	1102
Bretschneider, A.	Danielson	1	Sept. 3	1081
Bristol Nurseries, Inc.	Bristol	5	Oct. 13	1132
Burr & Co., C. R.	Manchester, Ellington and Durham	500	Aug. 20	1075
Burroughs, Thos. E.	Deep River	3	Oct. 5	1129
Chapman, C. B.	Groton	1	Sept. 21	1110
Chapman, C. E.	North Stonington	4	Sept. 16	1098
Coari & Co.	Norwalk	2	Sept. 9	1085
Conine Nursery Co.	Stratford	50	Oct. 8	1131
Conley, L. D.	Ridgefield	8	Oct. 2	1124
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Aug. 7	1072
Conn. Agr. Experiment Station (W. O. Filley, State Forester)	New Haven	1	Oct. 18	1140
Crofut & Knapp Farm	Norwalk	20	Dec. 30	1159
Cross Highway Nurseries	Westport	6	Nov. 27	1151
Dallas, Inc., Alexander	Waterbury	1	Nov. 23	1149
Dowd, F. C.	Madison	1	Sept. 22	1112
Elm City Nursery Co., Woodmont Nurseries, Inc.	Woodmont and New Haven	155	Sept. 7	1082
Evergreen Nursery Co.	South Wilton	1	Sept. 10	1088
Fairfield Landscape & Nurseries Co.	Cannondale	5	Dec. 31	1160
Falcon's Flight Farms Nursery (B. Austin Cheney, Prop.)	Litchfield	1	Oct. 2	1123
Gardner's Nurseries	Cromwell	5	Aug. 31	1078
Geduldigs Greenhouses	Norwich	1	Nov. 5	1147
Glenn Terrace Ornamental Nursery (James H. Everett, Prop.)	Mount Carmel	4	Oct. 29	1146
Goodwin Associates, Inc., the James L.	Hartford	1	Sept. 29	1122

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1920—*Cont'd.*

Name of Firm.	Address.	Average.	Certificate Issued.	No. of Certificate.
Hartford Park Commissioners	Hartford	1	Dec. 31	1161
Heath & Co.	Manchester	5	Aug. 20	1077
Hilliard, H. J.	Sound View	1	Sept. 16	1100
Hiti Nurseries (J. H. Bowditch, Prop.)	Pomfret Center	8	Sept. 3	1080
Holcomb, Irving	Simsbury	1	Sept. 15	1092
Horan & Son, Jas.	Bridgeport	1	Sept. 9	1086
Houstons' Nurseries	Mansfield	4	Dec. 23	1157
Hoyt's Sons Co. Inc., The Stephen	New Canaan	300	Oct. 19	1141
Hunt & Co., W. W.	Hartford	10	Sept. 28	1119
Intravaia, Joseph	Middletown	1	Aug. 31	1079
Isselee, Charles	Darien	10	Nov. 30	1152
Kelley, James J.	New Canaan	1	Sept. 9	1084
Kellner, Herman H.	Danbury	1	Oct. 2	1126
Keso Nursery (J. J. Kelsey, Prop.)	Clinton	1	Sept. 22	1113
Ladd & Nichols, Inc.	Greenwich	2	Nov. 23	1150
Laddin's Rock Nursery (W. L. Marks, Prop.)	Stamford	5	Oct. 13	1133
Larkin Bros., The	New London	2	Sept. 15	1095
Long, Mrs. J. A.	East Haven	1	Oct. 23	1144
Mallett Co., George A.	Bridgeport	1	Oct. 28	1145
Maplewood Nurseries (T. A. Peabody, Mgr.)	Norwich	1	Sept. 16	1099
Marigold Farm (H. Kelley, Prop.)	New Canaan	2	Sept. 21	1111
Meier & Gillette	West Hartford	2	Oct. 16	1136
Millane Tree Expert Co.	Middletown	1	Sept. 15	1093
New Haven Nurseries	New Haven	10	Nov. 30	1153
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Dec. 29	1158
New London Cemetery Association (Ernest E. Rogers, Pres.)	New London	1	Sept. 15	1096
New London County Nurseries (W. J. Schoonman, Prop.)	New London and Stonington	5	Dec. 3	1154
North-Eastern Forestry Co.	Cheshire	20	Sept. 9	1083
Oakland Nurseries	Manchester	5	Aug. 20	1076
Ouwerkerk & Van der Stam (2)	Yalesville	1	Oct. 16	1137
Palmer, Est. of L. M.	Stamford	5	Sept. 28	1120
Park Gardens	Bridgeport	1	Sept. 21	1107
Pequod Nursery Co	Yalesville	15	Sept. 23	1116
Phelps, J. Wesson	Bolton	1	Sept. 17	1103
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Dec. 13	1155
Pierson, A. N., Inc	Cromwell	50	Sept. 11	1089
Polish Orphanage (Rev. L. Bojnowski, Mgr.)	New Britain	1	Oct. 13	1134
Pomeroy, Edwin C.	Northville	1	Oct. 2	1127
Quality Seed Store	Stamford	1	Oct. 5	1128
Reck, Julius	Bridgeport	1	Sept. 21	1109
Rockfall Nursery Co. (P. Marotta, Prop.)	Rockfall	2	Aug. 30	1074
Saxe & Floto	Waterbury	1	Oct. 16	1139
Scheepers, Inc., John (2)	Sound Beach	6	Sept. 28	1121
Schleichert, F. C.	Bridgeport	1	Sept. 21	1108
Scott, J. W.	Hartford	5	Nov. 11	1148
Seely, C. H.	Darien	1	Oct. 20	1142

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1920—*Cont'd.*

Name of Firm.	Address.	Average.	Certificate Issued.	No. of Certificate.
Sierman, C. H.	Hartford	5	Oct. 22	1143
South Wilton Nurseries	South Wilton	5	Sept. 10	1087
Stannard Hill Greenhouses (J. E. Brooks, Prop.)	Westbrook	1	Sept. 22	1114
Steck, Charles A.	Bethel	2	Oct. 2	1125
Stratfield Nursery Co.	Bridgeport	4	Dec. 21	1156
Traendly & Schenck	Rowayton	2	Sept. 24	1117
Upson, R. E.	Marion	1	Oct. 16	1135
VanWilgen & Co.	Branford	3	Sept. 18	1105
Verkades Nurseries	New London	8	Sept. 15	1097
Vidbourne & Co., J.	Hartford	7	Oct. 7	1130
Wallace, Arthur T.	Wallingford	2	Oct. 16	1138
Wild, Henry	Riverside	1	Sept. 27	1118
Wilson & Co., C. E.	Manchester	10	Sept. 17	1101
Yale University Forest School	New Haven	1	Sept. 13	1090
Young, Mrs. Nellie A.	Pine Orchard	1	Sept. 18	1104
Total acreage		1,553		

INSPECTION OF IMPORTED NURSERY STOCK.

The establishment of Federal Quarantine, No. 37, which became effective June 30, 1919, has greatly reduced the quantity of nursery stock entering Connecticut from foreign countries. In fact it has prohibited general importation and the only kind now entering the state directly and needing inspection by state inspectors is stock for propagating purposes. This is nearly all Manetti rose stock, which is consigned to the larger florists' establishments, and fruit seedlings purchased by the larger nurseries that grow fruit trees. As these plants are small, a large number of them can be packed in a case of ordinary size. As only a few firms import such stock, the number of shipments received was much smaller than in preceding years, but the number of plants was in much greater proportion, as the following figures for 1919 and 1920 will show:

Year.	No. of Shipments.	No. of Cases.	No. of Plants.
1919	131	1,075	1,164,701
1920	17	87	814,491

Most of this stock was inspected by Messrs. Zappe, Chamberlain and Walden, and the time required amounts to 133 hours, or 17.7 days of seven and one-half hours each, or .68 months of 26 working days each. The cost according to the office accounts amounted to $825.83, including time of men and traveling expenses, and was paid out of the state appropriation for suppressing gipsy and brown-tail moths and inspecting nursery stock.

The sources of this imported nursery stock were as follows:—

SOURCES OF IMPORTED NURSERY STOCK, 1919–1920.

Country.	No. of Shipments.	No. of Cases.	No. of Plants.
France	8	31	359,300
Holland	4	20	152,691
England	4	28	290,000
Scotland	1	8	12,500
Total	17	87	814,491

The following table shows quantity of stock as inspected by months:—

Month.	No. of Shipments.	No. of Cases.	No. of Plants.
January	1	2	15,500
February	4	15	111,700
March	4	16	208,100
April	7	52	467,500
May	1	2	11,691
Total	17	87	814,491

Of the 17 shipments, 11 shipments or 64.8 per cent. were found to be infested with insects or plant diseases, some of which are pests.

Last year many imported bulbs were inspected, but this is now all done by Federal inspectors at the ports of entry.

Details regarding the infestations on imported nursery stock are as follows:—

PESTS FOUND ON IMPORTED NURSERY STOCK.

11 Shipments Infested.

Insects, etc.

Bulb Mite on Manetti rose. (1 shipment) Thos. Smith & Son, Stranraer, Scotland.

Emphytus cinctus Linn. on Rose. (7 shipments) R. H. Both, Wisbech, England. Franco-American Seedling Co., Angers, France. Thos. Smith & Son, Stranraer, Scotland. Levasseur & Fils, Ussy, France. S. Bide & Sons, Ltd., Farnham, Surrey, England. W. Fromow & Sons, Windlesham Surrey, England. As. Ouwerkerk, Boskoop, Holland.

Lepidopterous cocoons. (2 shipments) Kings Acre Nurseries, Henford, England. S. Bide & Sons, Ltd., Farnham, Surrey, England. Larva. (1 shipment) Felix & Dykhuis, Boskoop, Holland.

Sow bugs. (1 shipment) Levasseur & Fils, Ussy, France.

Spider. (2 shipments) Levasseur & Fils, Ussy, France. S. Bide & Sons, Ltd., Farnham, Surrey, England.

Staphalinid beetle on rose. (2 shipments) Thos. Smith & Son, Stranraer, Scotland. Felix & Dykhuis, Boskoop, Holland.

Vespula germanica Fabr. (1 shipment) Franco-American Seedling Co., Angers, France.

Woolly aphis on apple. (1 shipment) Franco-American Seedling Co., Angers, France.

Plant Diseases.

Crown Gall on rose. (5 shipments) Vincent Lebreton's Nurseries, La Pyramide, France. Franco-American Seedling Co., Angers, France. Felix & Dykhuis, Boskoop, Holland. W. Fromow & Sons, Windlesham Surrey, England.

INSPECTION OF APIARIES.

There has been no change in the system of apiary inspection or in the personnel of the inspectors since last year. The new law passed by the last General Assembly requiring beekeepers to register with their town clerks was generally though not fully observed, and proved quite a help to the inspectors in locating apiaries.

Mr. H. W. Coley of Westport has continued to inspect in Fairfield, New Haven, Middlesex and New London counties, and Mr. A. W. Yates of Hartford likewise has continued to inspect in Litchfield, Hartford, Tolland and Windham counties, each working on a basis of six dollars per day and expenses.

Many colonies of bees did not survive the winter, and though more apiaries were inspected than in 1919, the number of colonies was considerably smaller.

During the summer of 1920, 762 apiaries, containing 4,797 colonies of bees, were inspected as against 723 apiaries and 6,070 colonies in 1919. In making these inspections, 119 towns were visited in 1920 and 102 towns in 1919.

Inspections have never been made in the towns of Union (Tolland County) and Eastford (Windham County).

The following ten towns were visited in inspection work in 1920 for the first time:

Fairfield County—Sherman and New Fairfield.
New Haven County—East Haven.
Middlesex County—Essex, Chester and Middlefield.
New London County—Lebanon, Preston and Voluntown.

Inspections were made in the following 38 towns not visited in 1919:

Fairfield County—Brookfield, New Fairfield, Sherman and Trumbull.
New Haven County—Bethany, East Haven North Haven and Woodbridge.
Middlesex County—Chester, Clinton, Cromwell, Essex, Haddam and Middlefield.
New London County—Bozrah, Colchester, Franklin, Griswold, Preston and Voluntown.
Litchfield County—Barkhamsted, Canaan, Colebrook, Cornwall, Goshen, Morris, New Hartford, Norfolk, North Canaan, Roxbury, Salisbury, Sharon and Winchester.
Hartford County—Hartland and Simsbury.
Tolland County—Columbia, Ellington and Hebron.

On the other hand, inspections were made in 1919 in the following 29 towns, not visited in 1920:

Fairfield County—Bethel and Redding.
New Haven County—Oxford and Wolcott.
Middlesex County—East Hampton and Killingworth.
New London County—Groton, Old Lyme and Stonington.
Litchfield County—Bethlehem, Plymouth and Warren.

Hartford County—Avon, Canton, Manchester, Windsor and Windsor Locks.
Tolland County—Stafford, Tolland and Willington.
Windham County—Brooklyn, Killingly, Plainfield, Pomfret, Putnam, Scotland, Sterling, Thompson and Woodstock.

The percentage of apiaries infested with European foul brood has decreased each year since the inspection service was established. In 1920 it was only 4.3 per cent. as against 6.6 in 1919. The percentage of colonies, however, was 1.5 per cent. in 1920, slightly larger than the 1.2 per cent. found infested in 1919. This is due, not to any increase in the disease as the percentages of infested apiaries show, but to the smaller number of colonies in the average apiary, which is only 6.5 in 1920, as against 11.2 in 1919, on account of so many bees dying in the winter. During 1920, the European foul brood was found in the following 22 towns:

Fairfield County—Darien, Fairfield and Sherman.
New Haven County—North Haven, Prospect and Wallingford.
Middlesex County—Essex, Durham and Haddam.
New London County—Waterford.
Litchfield County—Barkhamsted, Bridgewater, Thomaston, Washington, Watertown and Winchester.
Hartford County—Glastonbury, Hartland, Marlborough and Southington.
Tolland County—Ellington and Mansfield.

American foul brood was found in nine apiaries and in five towns and was much less prevalent than in 1919, when it occurred in 22 apiaries in eight towns. In 1920, this disease was found in Wallingford (New Haven County), Durham (Middlesex County), East Lyme (New London County), Winchester (Litchfield County), and Wethersfield (Hartford County). Wallingford and East Lyme were infested in 1919.

The percentage of apiaries infested with American foul brood in 1920 is 1.18 and of colonies .25, as against 3.00 per cent. and 1.1 per cent. respectively in 1919.

The statistics of the apiaries inspected in 1920 in each of the 119 towns visited, are arranged by counties in the following pages and summarized on page 149:

Apiaries Inspected in 1920.

	No. Apiaries		No. Colonies	
	Inspected.	Diseased.	Inspected.	Diseased.
Fairfield County:				
Bridgeport	2	1	55	2‡
Brookfield	6	1	54	1‡
Danbury	18	0	163	0
Darien	3	1	28	1†

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* American Foul Brood.
† European Foul Brood.
‡ Sacbrood.

	No. Apiaries		No. Colonies	
	Inspected.	Diseased.	Inspected.	Diseased.
Easton	1	0	56	0
Fairfield	8	2	93	2‖†
Greenwich	7	0	102	0
Monroe	4	0	44	0
New Canaan	2	0	22	0
New Fairfield	4	0	34	0
Norwalk	7	0	66	0
Ridgefield	3	0	11	0
Shelton	2	0	24	0
Sherman	10	2	80	2†
Stamford	7	0	40	0
Stratford	3	0	33	0
Trumbull	2	0	14	0
Weston	2	0	2	0
Westport	8	0	76	0
Wilton	16	0	159	0
	115	7	1156	8
New Haven County:				
Beacon Falls	1	0	0	0
Bethany	3	0	7	0
Branford	4	1	45	1‡
Cheshire	2	0	26	0
Derby	4	0	31	0
East Haven	4	0	17	0
Guilford	3	0	18	0
Hamden	12	0	46	0
Madison	2	0	3	0
Meriden	26	0	155	0
Middlebury	2	0	14	0
Milford	3	0	32	0
Naugatuck	6	0	32	0
New Haven	3	0	10	0
North Haven	2	1	31	1†
Prospect	4	1	29	3†
Seymour	1	0	11	0
Wallingford°	17	7	106	9°
Waterbury	8	0	34	0
Woodbridge	4	0	16	0
	111	10	663	14
Middlesex County:				
Chester	4	0	15	0
Clinton§	1	0	0	0
Cromwell	7	1	26	1‡
Durham	6	3	65	4**
East Haddam	2	0	5	0

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* American Foul Brood.

† European Foul Brood.

‡ Sacbrood.

‖ Paralysis.

° 3 apiaries with 1 A. F. B. each, 3 with 1 E. F. B. each, 1 with 2 A. F. B. and 1 E. F. B.

** 1 A. F. B., 1 E. F. B. and 2 Sacbrood.

	No. Apiaries		No. Colonies	
	Inspected.	Diseased.	Inspected.	Diseased.
Essex	4	2	16	2†
Haddam	3	1	16	2†
Middlefield	5	0	30	0
Middletown	19	0	85	0
Old Saybrook	2	0	7	0
Saybrook	6	0	24	0
Westbrook	2	0	8	0
	61	7	297	9
New London County:				
Bozrah	4	1	40	1‡
Colchester	14	1	30	1‡
East Lyme	4	1	15	1*
Franklin	1	0	6	0
Griswold§	4	0	1	0
Lebanon	4	1	10	1‡
Lisbon	3	0	7	0
Montville	7	0	18	0
New London	1	0	10	0
Norwich	6	0	369	0
Preston	5	1	19	1‡
Voluntown‖	4	0	2	0
Waterford	3	1	18	4†
	60	6	545	9
Litchfield County:				
Barkhamsted	4	2	74	5†
Bridgewater	7	2	37	3†
Canaan	6	0	29	0
Colebrook	1	0	10	0
Cornwall	2	0	2	0
Goshen	4	0	20	0
Harwinton	1	0	3	0
Litchfield	7	0	27	0
Morris	6	0	27	0
New Hartford	5	0	24	0
New Milford	14	0	101	0
Norfolk	5	0	10	0
North Canaan	10	0	88	0
Roxbury	5	0	22	0
Salisbury	6	0	42	0
Sharon	8	0	66	0
Thomaston	6	1	38	3†
Torrington	6	1	84	1‖
Washington	10	1	86	2†
Watertown	13	2	70	3†
Winchester	19	5	54	8§
	145	14	914	25

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* American Foul Brood.
† European Foul Brood.
‡ Sacbrood.
‖ All bees killed in 3 aparies.
§ 4 A. F. B. and 4 E. F. B.

	No. Apiaries		No. Colonies	
	Inspected.	Diseased.	Inspected.	Diseased.
Hartford County:				
Berlin	18	0	136	0
Bloomfield	11	0	85	0
Bristol§	1	0	0	0
Burlington	1	0	5	0
East Granby	6	0	28	0
East Hartford	15	0	58	0
East Windsor	9	0	97	0
Enfield	3	0	22	0
Farmington	22	0	49	0
Glastonbury	17	1	55	2†
Granby	4	0	47	0
Hartford	26	0	92	0
Hartland	2	1	4	2†
Marlborough	2	1	22	3†
New Britain	17	0	69	0
Newington	10	0	51	0
Plainville	5	0	35	0
Rocky Hill	8	0	10	0
Simsbury	3	0	6	0
Southington	12	2	65	7†
South Windsor	8	0	22	0
Suffield	1	0	7	0
West Hartford	24	0	57	0
Wethersfield	13	1	44	1*
	238	6	1066	15
Tolland County:				
Andover	1	0	1	0
Bolton	1	0	4	0
Columbia	3	0	10	0
Coventry	2	0	10	0
Ellington	13	1	49	1†
Hebron	3	0	6	0
Mansfield	3	2	36	16†
Vernon	5	0	36	0
	31	3	152	17
Windham County:				
Windham	1	0	4	0

SUMMARY.

County.	No. of Towns.	No. Apiaries		No. Colonies	
		Inspected.	Diseased.	Inspected.	Diseased.
Fairfield	20	115	7	1156	8
New Haven	20	111	10	663	14
Middlesex	12	61	7	297	9
New London	13	60	6	545	9
Litchfield	21	145	14	914	25
Hartford	24	238	6	1066	15
Tolland	8	31	3	152	17
Windham	1	1	0	4	0
	119	762	53	4797	97

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* American Foul Brood.

† European Foul Brood.

§ 6 colonies winter killed.

	No. Apiaries	No. Colonies
Inspected	762	4,797
Infested with European foul brood	33	72
Per cent. infested	4.3	1.5
Infested with American foul brood	9	12
Per cent. infested	1.18	.25
Sacbrood	9	11
Bee Paralysis	2	2
Average number of colonies per apiary		6.5
Cost of inspection		$1,954.55
Average cost per apiary		$2.565
Average cost per colony		.41

REPORT OF WORK IN SUPPRESSING THE GIPSY AND BROWN-TAIL MOTHS.

Season of 1919-1920.

BY W. E. BRITTON, IRVING W. DAVIS AND JOHN T. ASHWORTH.*

The plan and methods developed in preceding years has been followed with satisfactory results. Full and hearty co-operation between the Federal Bureau of Entomology and the state forces has resulted beneficially to both parties. Most effort has been directed against the gipsy moth as the brown-tail moth has not been abundant for several years. The gipsy moth has been held well in check and except in the towns of Thompson, Woodstock, Killingly, Brooklyn and Griswold, the number of infestations has been smaller than last year.

The gipsy moth work was considerably handicapped on account of labor and weather conditions. The former was mainly a lack of experienced men. New men were taken on the work, but before they had become at all proficient would leave for more remunerative positions. August was the beginning of a rainy spell which virtually lasted until the heavy snows came in February. The depth of the snow caused so much delay, that twelve pairs of snow-shoes were purchased and did excellent service while the snow lasted.

No new towns were found infested and no trace of the gipsy moth was found in seven of the towns that were infested a few years ago. These towns are as follows: Ashford, Mansfield, Windham, Scotland, Franklin, Sprague and Stonington.

As in the last two years, in the older infested towns, single egg-clusters were not counted as infestations. In the border towns and in the towns not previously known to be infested, single egg-clusters have been reckoned as infestations.

No special work was done against the brown-tail moth this winter, but during scouting for the gipsy moth the men kept a sharp lookout for brown-tail webs, but none were found.

NEW EQUIPMENT.

In 1918 a truck body was mounted on a Ford chassis, as was noted in the report for that year and this proved so satisfactory that during the summer of 1919 two new Fords with delivery bodies were purchased. These have given excellent service during the year past. The second-hand Buick car which was purchased in 1918 gave us considerable trouble, and in January, 1920, it was sold and a new Ford touring car purchased to replace it. This has been very satisfactory.

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*Note.—Mr. Davis who has been in charge of this field work for nearly seven years, resigned June 10, 1920, to accept a position with the Danielson Trust Company of Danielson. Mr. Ashworth who has been employed under Mr. Davis for nearly three years is now in charge of the field work. The details of the work in each town, table of statistics and new equipment have been prepared by Messrs. Davis and Ashworth, and I have written the introduction, the chapter on parasites and prepared the financial statements and recommendations, etc.—W. E. Britton.

Each year we have had to borrow one or more spraying machines from the Federal Government. This year it seemed advisable for the State to purchase apparatus, and a new automobile truck power sprayer was obtained similar to the one purchased in 1918 (for description see Report for 1918, page 273). As the price of spraying hose had advanced so much it was not thought wise to purchase more than twelve hundred feet of 1-in. hose and 50 feet of 2½-in. suction hose. (This hose has not proved satisfactory and much of it will have to be replaced.)

By the middle of February the snow was so deep that it was useless to continue scouting. An effort was made to borrow some snow-shoes for experiment, but as these could not be obtained, twelve pairs were purchased and during the rest of the winter were used with a great saving of time and effort.

LABOR AND BOARD.

At the close of the war practically all of the men who left this work to enter the service returned to it as soon as discharged. These men were all experienced and made a valuable addition to the force. With the trades advancing wages in all lines many of the men left to obtain higher wages elsewhere. This was particularly true of the new men who received the minimum wage, in the graduated wage-scale now in force. This shortage of men was felt keenly, especially as the winter came on for it proved to be the most severe of any winter we have had since this work started. With the aid of the Government forces, however, the scouting was completed, although it had to be continued so late that there was little time for the work of banding the trees.

Obtaining board continued to be one of the handicaps to the work. Such high wages were paid, that people who had formerly taken boarders found more money and shorter hours in the mills. It was therefore almost impossible to obtain board and when obtained, the price was so high as to be prohibitive to the men at the wages they were receiving. The men were therefore transported from the towns where they lived (in most cases Killingly) and brought back at night. For this purpose the Ford delivery trucks were a necessity, and have been used continuously since they were purchased.

FINANCIAL STATEMENT.

Appropriation for biennial period ending June 30, 1921	$70,000.00
Expended year ending June 30, 1920	33,081.11
Balance for current year	$36,918.89

CLASSIFIED EXPENDITURES FOR THE YEAR ENDING JUNE 30, 1920.

Salaries and Wages:		
I. W. Davis	$1,766.62	
J. T. Ashworth	1,435.00	
J. A. McEvoy	1,241.92	
K. E. Buffington	1,198.80	
C. A. Burdick	1,218.32	
F. C. Rich	1,222.84	
J. Knight	400.88	
W. P. Colvin	1,073.25	
C. W. Roth	472.23	
A. J. Gilbert	1,019.33	
R. F. Franklin	856.60	
C. Ladd	454.44	
D. La Belle	858.82	
J. W. Longo	979.91	
R. G. Newton	798.70	
P. H. Shea	1,000.36	
T. Perreault	651.66	
G. D. Stone	620.32	
A. J. Duprey	541.51	
Other labor	2,534.46	
		$20,345.97
Printing and Illustrations		29.91
Postage		18.24
Stationery		12.28
Telegraph and Telephone		54.66
Office Supplies		71.05
Express, Freight and Cartage		10.92
Machinery, Tools and Supplies		8,433.69
Insurance		608.49
Rental and Storage		220.77
Traveling Expenses, Gasoline, etc.		1,262.19
Automobile Tires and Repairs		1,120.54
Inspection of Imported Nursery Stock		825.83
Heat and Light		58.57
Miscellaneous		8.00
Total		$33,081.11

DETAILS OF GIPSY MOTH WORK BY TOWNS

The following pages give a detailed account of the gipsy moth work in each of the towns infested:

THOMPSON—134 Infestations—4,342 Egg-clusters.

As was true of the scouting in many of the towns this past winter, the work in Thompson was greatly handicapped by the heavy snows and stormy weather. The work was finished about the last of March, and resulted in finding one hundred and thirty-four infestations containing four thousand three hundred and forty-two egg-clusters.

These colonies were spread over the entire town, but were a little more scattered in the western part than in the central and eastern portions. Where so many colonies are present it is difficult to indicate which are the most serious, but some of the larger may be mentioned.

One on land of Warren Logee about a mile from Brandy Hill, contained three hundred and twenty egg-clusters. These were found on three trees and a nearby stone wall.

A colony in woodland owned by Mrs. J. M. Robinson was found to contain one hundred and eighty-nine egg-clusters, and the examination of an infested stone wall about two miles further north resulted in the finding of two hundred and eighteen more.

In the western part of the town the largest colony was in pasture land owned by Mr. Fred Parker and situated near Fabyan. At this colony the one hundred and ninety egg-clusters were found in a stone wall and four oak trees.

Some tanglefoot was applied in this town, but as it was one of the last to be banded, larvae were observed before the work was quite completed.

During June, eighty-nine of the largest colonies and those most exposed to wind-spread, were sprayed with one of the truck sprayers, and after the spraying season was over, scouts were sent out to visit and inspect all colonies in the town and note the results from spraying; one thousand eighty-two larvae were found and destroyed.

WOODSTOCK—41 Infestations—882 Egg-clusters.

Woodstock, besides being one of the largest towns in Connecticut, has a large road mileage. Many of these roads are old and have been discontinued for several years so that they are no longer passable, but in the gipsy moth work we have always considered them as thoroughfares and scouted them accordingly. From this fact it will be seen that the area of Woodstock is well covered in each years' scouting. This year proved no exception as this was the first town scouted and the work was largely done by the older men. As soon as it was deemed practicable all of the older men who could be spared were sent to work in the western part of Woodstock, and new men were added as fast as they were trained. One crew was withdrawn in the middle of October for work in Canterbury, and another the first of November to scout Eastford.

The rainy weather during the autumn months caused many delays in the work both from the actual time lost and from the poor roads. The scouting was completed on the twenty-eighth day of November, and resulted in finding forty-one colonies of the gipsy moth. These colonies were mostly found in the northeast and southwest portions of the town, with scattering ones in the southeast corner, while the northwest portion was very free from this pest. The majority of these colonies contained less than twenty egg-clusters, while the largest colony contained two hundred and twenty-eight. The latter was a woodland colony and found on land of Mr. Shead near the Thompson line. While this colony was scattered over several acres, the timber was cut late in the fall and no further work was deemed necessary this winter.

Other large colonies were on land of Samuel Ide in the northerly part of the town, on land owned by Sidney P. Butler and Irving Perry in West Woodstock, and that on land of Charles Clark near Eastford.

At sixteen of the forty-one colonies, tanglefoot bands were placed around the trees as they were on land that was open and high, and therefore gave a good chance for wind-spread.

Thirty-one of the larger colonies were sprayed during the season using about 425 pounds of arsenate of lead. In all three hundred and twenty-five larvae were found and destroyed; only six, however, were found alive after spraying, four of which were found at infestation No. 35, where one hundred and twenty-five dead larvae were found at the same time.

UNION—1 Infestation—1 Egg-cluster.

Union was scouted by the state men this year, and as there was but little time remaining before the eggs would hatch, only the eastern portion of the town was covered. One egg-cluster was found, and that on a small oak near the Massachusetts line. The nearby growth was carefully scouted, but no other evidences of the pest were found. No spraying was done, but the territory around the infestation was watched during the larval season and nothing found.

PUTNAM—15 Infestations—482 Egg-clusters.

There was a notable decrease in the gipsy moth colonies in this town this past year. Only fifteen colonies containing four hundred and eighty-two egg-clusters were located, and the most of these lay to the west of the city of Putnam.

The largest colonies were found in woodland during the early fall and contained nearly half of the egg-clusters found in the town. These, two in number, were both in the eastern part of the town and covered a large area; in one case, forty trees being infested and in the other ninety-four. The danger of spread from these infestations is very small, as they are located so that they are not exposed to the wind.

A group of four colonies found on the hill to the east of the Grove Street cemetery are in an exposed location. While these colonies contained only forty-eight egg-clusters in all, they will need careful attention because the growth on this hill is rather light and therefore is badly wind-swept.

Several of these colonies were banded with tanglefoot during May, and in June ten of the fifteen colonies were sprayed. In looking over the colonies during the latter part of July and the first of August, one thousand six hundred sixteen larvae were found and destroyed, over half of them being just outside infestation No. 14, along a stone-wall containing a number of egg-clusters which were covered with snow when the country was scouted last winter.

POMFRET—22 Infestations—274 Egg-clusters.

The western half of this town was scouted just before the heavy snows of last winter. These storms caused the work in this town to be stopped about the first of February. It was later resumed, however, and the town finished the last part of April.

Only twenty-two infestations were found and these may be roughly divided into three groups, one in each of the three corners of the town, while the fourth, the northeast, contained but one colony.

The colonies were all small, considering that Pomfret has been infested for seven years, the largest having only thirty-six egg-clusters. In several of the colonies the trees were banded with tanglefoot and following that were examined for larvae prior to spraying.

In June, eleven of the largest colonies were sprayed with arsenate of lead, and after the spraying season was over all colonies were inspected to determine the results obtained, and in all colonies sprayed and not sprayed a total of only six hundred sixty larvae were found and destroyed.

EASTFORD—10 Infestations—178 Egg-clusters.

A glance at the map of Connecticut will show the peculiar shape of the town of Eastford. A long narrow portion, bounded by Ashford, Union and Woodstock, extends northward, while the southern part is broader and more rectangular in shape. In this northern portion was located only one of the one hundred and seventy-eight egg-clusters found in this town. The majority of both colonies and egg-clusters were found in a group to the north and northeast of Phoenixville.

All of the gipsy moth colonies found in Eastford were in either pasture or woodland. None were considered serious, and the largest colony contained only forty egg-clusters. This was in some woodland owned by Mr. Charles Wheaton and situated to the east of the road which leads past Crystal Lake.

Several of the colonies were banded early in May, and nine of the ten were sprayed during the month of June, three thousand gallons of spray mixture being used. In checking up the results after spraying, the men were unable to find a single larva at any of the colonies, although six hundred fifteen were destroyed before spraying.

KILLINGLY—46 Infestations—1,579 Egg-clusters.

Late in the summer of 1919, considerable woodland scouting was done in Killingly, and three infestations were located on the ridge about a mile east of the Borough of Danielson. This woodland was cut over during the winter and it is doubtful if it would pay to spray it.

In the winter scouting, the entire town proved to be infested, the only locality which was free of colonies being in the southwest corner of the town. This is explained by the fact that this section is rather open, the growth being mostly scrub-oak and pine.

Two of the colonies are worth noting, both of which were found in the northeastern corner of the town. One of these contained three hundred and thirty and the other three hundred and twenty-nine egg-clusters. The former was on land owned by William Roberts and situated a little south of the Putnam line. The infested growth was three apple trees in a pasture, but was so located that the spraying could be done with a hand-sprayer.

The latter was at the northern end of Chestnut Hill on land belonging to Mrs. Roxy Bartlett. This is about a mile south of the former infestation "as the crow flies." The egg-clusters here were found mostly in a stone wall by the roadside, although an oak and apple tree were also infested.

During the latter part of May, six hundred and fourteen tanglefoot bands were applied to trees at twenty-nine of the infestations, following which thirty-eight of the forty-six infestations were sprayed, one truck sprayer and a small hand sprayer being used. Two thousand forty-five larvae were found and destroyed; of this number, only thirty-four were located after the colonies had been sprayed.

BROOKLYN—20 Infestations—499 Egg-clusters.

When the snow became so deep in February, one of the scouting crews were sent into Brooklyn. As the scouts were all living in Danielson, the eastern part of the town was scouted first, most of the work being done on snow-shoes. After the snow had disappeared, many of the colonies were examined again for egg-clusters which might be found beneath the snow line.

The eastern section of the town contained most of the colonies, only one being found in the extreme western part. This one, however, was the largest found in Brooklyn, and contained one hundred and thirteen egg-clusters. This colony was on a high elevation in a wooded pasture owned by Joseph Stetson. As this was a wind-swept area, careful work was done to prevent spread from it.

Most of the other colonies were small, and not of great importance. Two colonies which contained seventy-six and one hundred and thirteen egg-clusters, respectively, were so situated that control measures were easily accomplished. The former was in an old apple tree which was cut down, and the latter was in a swamp to the west of Tatnic Hill, where spread by means of wind would be largely eliminated.

At twelve of the colonies, three hundred ninety-four bands of tanglefoot were put around the trees the early part of May, and in June fifteen were sprayed, two thousand three hundred gallons of spray mixture being used. A total of five living larvae were found at four of the colonies when the men looked them over during the latter part of July.

HAMPTON—5 Infestations—6 Egg-clusters.

Though the number of gipsy moth egg-clusters found in the various towns of this state has remained about the same as last year, in Hampton there has been a marked decrease. This year fewer infestations and fewer egg-clusters were found than in 1914, when the town was first found infested.

In three of the five colonies, the trees were banded with tanglefoot, and as there were so few egg-clusters, spraying was not considered necessary.

CHAPLIN—1 Infestation—3 Egg-clusters.

Only one infestation of gipsy moths was found in Chaplin during the past season's scouting. This was a small colony and was found in an orchard on land owned by Mr. Murphy near the northeastern part of the town. The trees were banded with tanglefoot during the latter part of May. It was not thought necessary to spray this colony. A close watch was kept but no larvae were found.

STERLING—9 Infestations—177 Egg-clusters.

The Moosup River flowing to the west from Rhode Island divides Sterling into a north and south portion of very nearly equal areas. All of the colonies of the gipsy moth found in Sterling this year were to the north of this river. None of these colonies contained a very large number of egg-clusters, the largest colony being that found on land of Mr. G. R. Brown, which totaled fifty-eight. This was located in an apple tree by the roadside and adjacent stone wall. Another colony about a mile northwest of this one, was that on land of John Dixon. This was on a hill which has an elevation of six hundred forty feet, and as that is rather high for that locality, the danger from wind-spread is great.

The trees in most of the colonies in Sterling were banded with tanglefoot early in May. All but one of the colonies in Sterling were sprayed, that being one on land of the Hillside Farm near North Sterling, twenty-two of the twenty-four egg-clusters being old ones, it was not thought advisable to spend the time that could be used to advantage elsewhere.

PLAINFIELD—10 Infestations—398 Egg-clusters.

This was one of the last towns scouted this year, and as the season was so far advanced only the southern portion of the town was well covered. In the northern section, the scouting was done only around the infestations of the previous year.

The largest colony located was on the western slope of Black Hill in the western part of the town. This colony contained two hundred and eleven egg-clusters and was in some pasture apple trees. While this infestation is in a wind-swept locality it is rather easy to control, as there is but little growth near it. The few trees which are there were banded with tanglefoot early in May.

Another colony of importance was found on what is known as the Green Hollow road near the Killingly Line. This was found in a group of pasture oaks on land owned by Mr. Charles A. Tillinghast, and contained sixty-one egg-clusters. In several of the most open and wind-swept colonies, the trees were tanglefooted and later all of them were sprayed, the hand sprayer being used at two of the colonies; very few larvae were found after spraying and a large portion of them were dead.

CANTERBURY—9 Infestations—126 Egg-clusters.

One of the crews started scouting in Canterbury about the middle of October and finished the first of December. This was more time than it was planned to spend in this town, but the delay was largely due to the excessive rains.

Nine infestations were the result of this scouting, and these were scattered throughout the town. They contained a total of one hundred and twenty-six egg-clusters, about half of which were a year old. The colonies were all rather small, the largest containing thirty egg-clusters. This colony was found in an old orchard in the northern part of the town near the village of Wauregan.

The most serious infestation was probably one located near the Brooklyn line on land owned by Mr. Kerr. This consisted of twenty-three egg-clusters and was found in some oaks on a rather high elevation about half a mile from the nearest traveled road. During the month of May the trees in six of the infestations in this town were banded with tanglefoot.

Eight of the nine infestations were sprayed in June, one thousand eight hundred gallons of solution being used. It was not thought advisable to spray infestation No. 6, as there was only one new egg-cluster found. Three hundred and twenty-four larvae were found and destroyed during the season.

VOLUNTOWN—2 Infestations—2 Egg-clusters.

During the past winter, only two egg-clusters of the gipsy moth were found in this town, and both of these were in the northern part, but about three miles apart. These were not considered serious enough to warrant further work.

GRISWOLD—11 Infestations—33 Egg-clusters.

The colonies of the gipsy moth found in Griswold were all small, the largest containing only ten egg-clusters. All but two of these were found to the north of the Griswold Post Office. In the most serious of these colonies the trees were banded early in May.

Three colonies in Griswold were sprayed, four hundred and seventy-five gallons of solution being used. No larvae were found at the colonies during the season.

LISBON—1 Infestation—1 Egg-cluster.

The Federal men scouted Lisbon during the past winter and found but a single egg-cluster. This occurred in the western part of the town near the Sprague line. It was not thought serious enough to warrant the banding of the trees with tanglefoot and no spraying was done.

PRESTON—6 Infestations—127 Egg-clusters.

Though one hundred and twenty-seven gipsy moth egg-clusters were found in Preston during the past winter, one hundred and twenty-two of them were in two colonies. These two colonies were close together and a little to the north of the state road leading from Norwich to Preston City.

One of these infestations was located on land of Frank Ayer and contained one hundred and ten egg-clusters. This was in open woodland on some large oaks, but on rather low ground and from which there is little danger of wind-spread.

The other large colony was in an orchard belonging to Steve Stanewiez. There were but few trees found infested, but all of the trees in the orchard have cavities in them which make control measures difficult.

At four of the colonies the trees were banded with tanglefoot in May, and in the early part of June the two above-mentioned infestations were sprayed.

NORWICH—5 Infestations—74 Egg-clusters.

The result of the winters' scouting in the town of Norwich was the discovery of five colonies. Three of these contained but a single egg-cluster each and all of this group were located in the northeastern part of the town. The largest colony of forty-two egg-clusters was just inside the city limits, in the south part of the city. These were in an oak tree and stone wall, but there was very little growth near it. The most serious colony was in the western part of the town near the Bozrah line on the top of Wawecus Hill, which has an elevation of over four hundred feet. The colony is in roadside maples and apple trees and therefore is badly wind-swept which may cause spread. The trees in this vicinity were banded early in May with tree tanglefoot, and were watched during the summer but no larvae found.

In the early part of June two of the colonies were sprayed.

Bozrah—1 Infestation—4 Egg-clusters.

Only one infestation was found in Bozrah and that on land owned by Mr. R. A. Bethan and located near the Norwich line. The trees in this colony were banded during the month of May, and sprayed in June.

North Stonington—1 Infestation—29 Egg-clusters.

Although only one infestation is listed as being found within the limits of this town, there were several single egg-clusters which were not counted as infestations. These were found well scattered throughout the town. The infestation noted was found close to the Hopkinton, R. I., line on land owned by Mr. Thomas Wheeler and the trees in this vicinity were banded early in the month of May. This infestation was sprayed on June 9th and during July most of singles were inspected at the same time as the above-described infestation and thirty-six larvae were found and destroyed; twenty-six of these larvae were at a single egg-cluster infestation situated near the Stonington line.

Ledyard—3 Infestations—4 Egg-clusters.

All of the gipsy moth colonies found in Ledyard were in apple orchards, and all were small, there being only four egg-clusters found in the entire town. The trees near two of these infestations were banded with tanglefoot, and one was sprayed in June.

Groton—1 Infestation—1 Egg-cluster.

Only one egg-cluster was found in Groton, and this was in the extreme northern part of the town. Aside from the creosoting of the egg-cluster no other work was considered necessary.

The statistics of this work as applies to each town and given in the preceding pages are summarized in the following table:

Statistics of Infestation.

Town.	Infestations.	Egg-clusters.	Tanglefoot Bands.	Sprayed.	Larvae.
Thompson	134	4,342	216	89	1,082
Woodstock	41	882	83	31	328
Putnam	15	482	264	10	1,616
Pomfret	22	274	53	11	660
Eastford	10	178	20	9	615
Ashford	0	0	0	0	0
Killingly	46	1,579	614	38	2,045
Brooklyn	20	499	394	15	251

Statistics of Infestation—*Cont'd.*

Town.	Infestations.	Egg-clusters.	Tanglefoot Bands.	Sprayed.	Larvae.
Hampton	5	6	35	0	0
Chaplin	1	3	10	0	0
Sterling	6	177	133	5	17
Plainfield	10	398	78	10	614
Canterbury	9	126	129	8	324
Scotland	0	0	0	0	0
Mansfield	0	0	0	0	0
Voluntown	0	0	0	0	0
Griswold	11	33	81	3	0
Lisbon	1	1	0	0	0
Sprague	0	0	0	0	0
North Stonington	2	29	24	1	36
Stonington	0	0	0	0	0
Groton	1	1	0	0	0
Union	1	1	0	0	0
Windham	0	0	0	0	0
Preston	6	127	51	2	24
Norwich	5	74	111	2	0
Ledyard	3	8	13	1	0
Bozrah	1	4	5	1	0
Franklin	0	0	0	0	0
21 Towns Infested	350	9,224	2,314	236	7,612

PARASITES.

In preceding years, an attempt has been made each year to liberate one or more species of the different parasites in some of the infested towns of the state, but owing to the weather and the labor conditions, we were unable to do it in 1920. However, collections of gipsy moth larvae were made in Thompson, Woodstock, Putnam, Pomfret, Killingly, Plainfield, Canterbury and Brooklyn, and sent to the Government laboratory at Melrose Highlands, Mass., in order to determine if any species of parasites could be recovered as a result of planting colonies. We are indebted to Mr. A. F. Burgess for much of the information regarding the planting and recovery of parasites, a full report up to that time being included in the Report of this Station for 1917, page 250. The following resumé brings the subject up to date, so far as Connecticut is concerned.

Calosoma sycophanta Linn.

Though not a parasite, both adults and larvae of this large ground beetle devour the caterpillars of the gipsy moth and it is therefore quite an important agency for holding that species in check. It was liberated in Stonington in 1914, in Thompson in 1915, and in Killingly in 1917. This species now seems to be fairly well distributed over the state, as it has been collected or observed in Thompson, Putnam, Killingly, Scotland, Plainfield, Groton, Lyme, Clinton, New Haven, Meriden and Darien. Our employees have reported observing these beetles feeding upon gipsy moth larvae in Thompson and Killingly in 1920.

Anastatus bifasciatus Fonsc.

This very minute Hymenopterous egg parasite was first liberated in Connecticut in 1917, when colonies were placed in Thompson, Woodstock, Putnam, Killingly, Pomfret, Eastford, Brooklyn, Hampton, Chaplin, Mansfield and Canterbury. More colonies were planted in Brooklyn in 1918, Canterbury 1919, Eastford 1918 and 1919, Griswold in 1918, Hampton in 1918 and 1919, Killingly in 1918 and 1919, Ledyard in 1919, Mansfield in 1918, Norwich in 1919, Plainfield in 1918 and 1919, Pomfret in 1919, Putnam in 1918 and 1919, Scotland in 1918, Sterling in 1918 and 1919, Thompson in 1919, Voluntown in 1918 and 1919, and Woodstock in 1918.

This insect was recovered from Eastford in 1917, and from Voluntown in 1918.

Apanteles lacteicolor Vier.

This is a small Hymenopterous parasite of the brown-tail moth larvae. It has been colonized in Connecticut as follows: Putnam in 1912, Suffield, Hartford, Mansfield, Norwich, Stonington, Griswold, Plainfield, Killingly and Hampton in 1913, Manchester Chester, Colchester and Lebanon in 1915, East Lyme and Canterbury in 1916, Montville and Groton in 1917.

This species has been recovered as follows: Brooklyn 1916, Canterbury 1917, East Hartford 1916, Groton 1918, Hartford 1913 and 1914, Killingly 1916, Lebanon 1915, Pomfret 1913, Putnam 1917, Stafford 1917, Stonington 1915, Suffield 1915, Thompson 1913 and 1916, Waterford 1914, 1916 and 1917, Wethersfield 1916, Woodstock 1913, 1915 and 1916.

Pteromalus egregius Forst.

A minute Hymenopterous parasite of the brown-tail caterpillars not colonized in Connecticut, but recovered from Hartford in 1913 and 1914, and Putnam in 1915.

Monodontomerus aereus Walker.

A minute Hymenopterous parasite of the pupae of both gipsy and brown-tail moths. Not colonized in Connecticut but recovered from Putnam in 1911 and 1915, Hartford and Suffield in 1912.

Meteorus versicolor Wesm.

This is a minute Hymenopterous parasite of the brown-tail caterpillars, and though no attempt was ever made to colonize the species in Connecticut, probably some cocoons were mixed with those of *Apanteles lacteicolor* and thus it became distributed. It was recovered from Hartford in 1914, and from Brooklyn, Killingly, Thompson, and Woodstock in 1916, and from Groton in 1918.

Compsilura concinnata Meigen.

This is a medium-sized Dipterous parasite or two-winged fly of the family Tachinidae attacking both the gipsy and brown-tail moths. It was colonized at Putnam in 1912, Hartford in 1913, Mansfield, Plainfield and Stonington in 1914, Stafford, Suffield, Colchester, Norwich and Old Lyme in 1915, and Hampton and Scotland in 1917. It has been recovered from Woodstock in 1915, Stonington in 1916, Putnam, Stafford, Plainfield and North Stonington in 1917, Pomfret, Putnam and Stonington in 1918, Killingly, Plainfield, Pomfret, Putnam, Scotland and Thompson in 1919, and from Plainfield, North Stonington and Putnam in 1920.

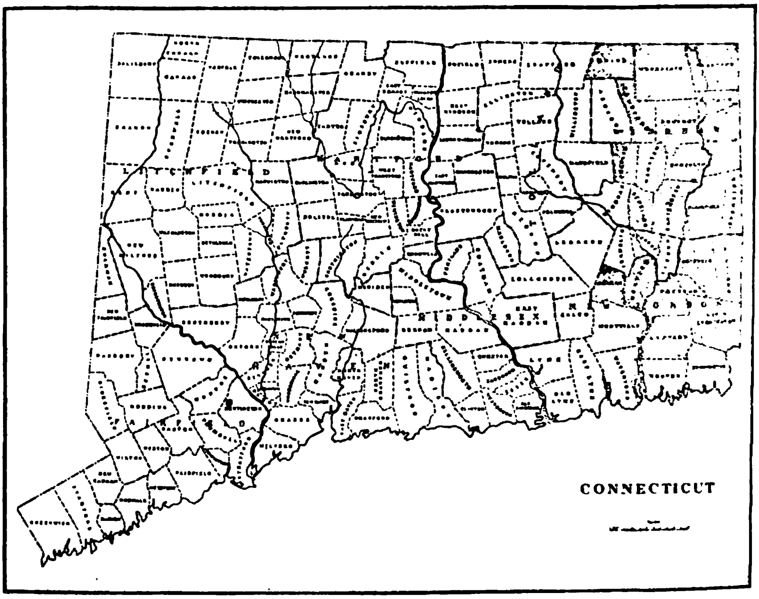

Figure 4. Map of Connecticut showing area quarantined on account of gipsy moth.

Sturmia (*Zygobothria*) *nidicola* Townsend.

This is another Tachinid fly of medium size parasitizing the larvae of both gipsy and brown-tail moths, and though never colonized in Connecticut, it was recovered from Canterbury and Waterford in 1917, and from Groton and Stonington in 1918.

The foregoing records of parasites lead us to believe that most of these species have become fairly well distributed around the infested portion of the state even though not actually planted there. Some help may therefore be expected from them in the years to come. The effectiveness of parasites depends much upon conditions, and is usually more pronounced in localities where the host is extremely abundant, and on account of the suppression work done, this has never been the case in Connecticut. Though parasites play an important part as a natural agency in controlling or holding in check a given species, they never exterminate their hosts. Of course, where conditions are like those in Connecticut, where their hosts are not very abundant and suppressive measures are being carried on, the parasites do not have the best kind of a chance. However, we are glad to know that they are still present.

QUARANTINE.

During 1919 eight Connecticut towns were removed from the Federal quarantined area as no traces of the gipsy moth had been found in them. This past winter three of these towns, Preston, Norwich and Bozrah, were again found to be infested and were added to the quarantined area.

The spread in the states of northern New England was very heavy and this gave rise to erroneous newspaper reports that there had been a great increase of the gipsy moth in Connecticut.

Only two towns, Groton and Stonington, were quarantined against the brown-tail moth, and as there were no webs of this insect found in this state last winter, it is doubtful if they are quarantined this year.

Under the Federal regulations, shipments going from the infested area to another state were inspected by the Federal agents, but shipments to another point within the state were not subject to inspection. This left the greater part of the state subject to infestation from the colonies in the eastern portion. Accordingly, after due notice, a hearing was held in Hartford on March 3, 1920, after which the following quarantine regulations were established:

STATE OF CONNECTICUT
OFFICE OF STATE ENTOMOLOGIST
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

Quarantine Order No. 2.

Concerning Gipsy and Brown-Tail Moths.

In order to protect uninfested parts of Connecticut from danger of infestation by the gipsy moth and the brown-tail moth, under authority given in Section 2106 of the General Statutes, the following regulations are hereby established.

1. The towns of Union, Woodstock, Thompson, Eastford, Pomfret, Putnam, Chaplin, Hampton, Brooklyn, Killingly, Scotland, Canterbury, Plainfield, Sterling, Lisbon, Griswold, Voluntown, Ledyard and North Stonington because of the gipsy moth, and all the above-named towns and Groton and Stonington because of the brown-tail moth are now under

quarantine by the Federal Horticultural Board of the United States Department of Agriculture, and it shall be unlawful to remove from this quarantined area any woody nursery stock, lumber, cordwood, telegraph or telephone poles, railroad ties, or other forest plant products, unless the products shall have been inspected and certified by an authorized state or Federal inspector.

2. In view of possible future changes in the lines between the infested and non-infested areas of the State, the areas quarantined by the State shall conform to those quarantined by the United States Department of Agriculture; furthermore the regulations established by the Federal Horticultural Board of the United States Department of Agriculture for interstate shipments, are hereby adopted for the inspection and certification of similar shipments from the quarantined area to points outside of this area within the State of Connecticut.

3. This order shall take effect from its date.

Dated March 23, 1920.

E. H. Jenkins,
Director, Connecticut Agricultural
Experiment Station.

Approved
M. H. Holcomb,
Governor.

Instructions to Nurserymen, Lumbermen, Wood Dealers, Shippers and Transportation Companies.

Any shipments of nursery stock, or forest products originating within the quarantined area must not be shipped out of that area into the territory not infested, unless inspected and accompanied by the inspector's certificate. All shipments going into other States must be examined by a Federal Inspector, and the Federal Inspectors have also been authorized to inspect shipments consigned to points within the State: the State inspector can also examine such shipments in case of convenience or if the Federal Inspectors are busy elsewhere.

Transportation companies must not accept nursery stock or forest products consigned to points outside of the infested area unless accompanied by certificate of inspection.

INSPECTORS.

Federal Inspectors.

Herbert J. Miles, P. O. Box 62, Putnam, Conn. Telephone 321-14, Putnam. Inspector for Windham and Tolland Counties.

William J. Ahearn, Box 63, Westerly, R. I. Telephone 2277, Westerly. Inspector for New London County.

State Inspector.

John T. Ashworth, 26 Reynolds St., Danielson, Conn. Telephone 28-3, Danielson. Inspector for any shipments not going outside of the State.

So far the inspections have all been made by the Federal inspectors, and reports of all shipments to uninfested parts of Connecticut are sent to the office of the State Entomologist, where they are placed on file. The Federal quarantine also covers field stone and quarry products, but apparently our state law (Section 2106) provides only for the control of shipments of plants or plant products.

INFESTATIONS DISCOVERED IN NEW JERSEY AND NEW YORK.

In midsummer an infestation of about one hundred square miles in extent was discovered on the Duke estate at Somerville, N. J. From a nursery on this estate many shipments had been sent during the past few years and in following up the destinations of these shipments several smaller infestations were found in New Jersey and one in Brooklyn, N. Y. Through the kindness of Mr. A. F. Burgess of the Bureau of Entomology, reports were received of eleven shipments of nursery stock from the Duke estate consigned to six parties in Connecticut. Most of these shipments were made between 1913 and 1916 and were sent to Greenwich, Stamford, Fairfield, Bridgeport, Ridgefield and Sharon.

Messrs. B. H. Walden and M. P. Zappe, Assistant Entomologists of the Station visited all of these places and inspected the plantations in and around the places where these plants were set. No indications were found of the presence of the gipsy moth in any of these places.

RECOMMENDATIONS.

On account of the existing conditions, we have reason to believe that the gipsy moth is now well in hand in Connecticut. If the work should be stopped, the pest would soon become sufficiently abundant to cause noticeable damage to trees by stripping them in June. State action would then be demanded. Such a possibility should not for a moment be considered, because the experience of Massachusetts shows its folly. Though confined to a rather small area in Massachusetts when the work stopped in 1900, the pest became so troublesome that the work was again taken up in 1905, but it was found to have spread over an area more than six times its former size and the difficulty and cost of control correspondingly increased. In Connecticut, the gipsy moth should be held just where it now is or the infested area reduced if possible.

Federal co-operation has been most cordial and satisfactory, but the Federal appropriation was reduced, and on account of the rather rapid spread northward, extra work was needed in Maine, New Hampshire and Vermont. Then, too, during the past summer new infestations were discovered in the states of New Jersey and New York, thus requiring that a portion of the Federal appropriation be used in those States.

The Connecticut forces are now fairly well equipped with spraying machinery and supplies, and with motor vehicles. The initial outlay for new apparatus should, therefore, not be very heavy for the next two years. Federal quarantine No. 37 has resulted in keeping out much of the imported nursery stock which formerly had to be inspected out of this appropriation. There will still be considerable fruit stock and Manetti rose stock for propagating, that must be inspected, but the quantity will be relatively small, and the cost of inspection considerably less than in former years. As will be seen from the financial statement on page five, the cost of this work for the past year was $825.83, and it will probably be about the same for each season.

The appropriation for gipsy moth work should be sufficiently large, together with the possible Federal aid, to cope with any emergency such as a serious wind-spread. All things considered, we therefore respectfully request that sixty thousand dollars ($60,000.00) be appropriated for the biennial period ending June 30, 1923, for the purpose of suppressing the gipsy moth, the browntail moth, and for inspecting imported nursery stock.

EXPERIMENTS IN DUSTING IN COMPARISON WITH SPRAYING TO CONTROL APPLE INSECTS.

On March 30, 1920, entomologists from New York, New Jersey, Pennsylvania, Connecticut, and the U. S. Department of Agriculture held a conference at the Grand Central Station in New York City to consider a common plan for the testing of dust mixtures. It was agreed that it seemed desirable to conduct experiments in each of the states represented, to ascertain whether the common pests of the apple orchard could be satisfactorily controlled by dusting operations, and especially to learn if the addition of nicotine sulphate to the dust would control apple aphids and red bug.

The secretary afterwards prepared copies of the general plan of experiment and sent them with the minutes of the conference, to each entomologist who had been in attendance. In general the plans called for a dust containing 90 per cent. sulphur, and 10 per cent. arsenate of lead, to which nicotine sulphate was to be added in three different proportions, *viz.*, one-half of one per cent., one per cent., and three per cent. It was also recommended that one plot should be sprayed and one left untreated for purposes of comparison; that not less than 100 trees be included in the experiment; that standard varieties and rather large trees be used if feasible; and that at least four treatments be given (delayed dormant; prepink, calyx, and young fruit). In other respects the operations were to be conducted in conformity with the demands of the orchard and practices of the region where the work was conducted.

After examining several orchards, one owned by Mr. William F. Platt of Milford seemed to meet most fully the requirements. This orchard contained 30 acres, most of the trees having been planted 26 years, was in sod and was situated just over the line in the town of Orange. Consequently arrangements were made with the owner, to allow us to experiment on his trees and to furnish team and help where needed. The Station was to furnish materials and the owner was to have the fruit crop. The owner had given the entire orchard a dormant treatment with "Scalecide," one part in fifteen parts of water.

The detailed plan of the experiment was developed through the co-operation of the Entomological and Botanical Departments of this Station and the Division of Deciduous Fruit Insect Investigations of the Federal Bureau of Entomology, which has for several years maintained at Wallingford, Conn., a field station for the study of orchard insects.

To the owner, Mr. William F. Platt, to the Bureau of Entomology, to The Niagara Sprayer Company, and to the Botanical Department of this Station, our thanks are due for help and co-operation to make this work possible.

Most of the actual work was done by Messrs. B. A. Porter and C. H. Alden, of the Wallingford field station of the Bureau of Entomology, E. M. Stoddard and G. E. Graham of the Botanical Department, and M. P. Zappe, B. H. Walden, P. Garman and W. E. Britton of the Entomological Department of this Station.

The dust was applied with a Niagara power duster, owned by the Federal Bureau of Entomology and used in the experiments last year at Wallingford. Dr. Quaintance and Mr. Porter kindly granted us permission to use this machine. It was hauled about the orchard with a pair of horses owned by Mr. Platt as is shown on Plates IV and V, a. The liquid spray was applied with the owner's regular sprayer (a Friend power outfit) which is shown on Plate V, b.

The dust mixtures were prepared by the Niagara Sprayer Co., Middleport, N. Y., and 300 lbs. each of Formulas 1, 2, and 3, were furnished gratis for the experiments. These amounts were not sufficient, and later 100 lbs. Formula 1, 100 lbs. Formula 2, and 200 lbs. Formula 3, were purchased from this firm.

Mixtures Used.

Formula 1	Powdered sulphur, 90 per cent.
Dust	Powdered lead arsenate, 10 per cent.
	Nicotine sulphate, one-half per cent.
Formula 2	Powdered sulphur, 90 per cent.
Dust	Powdered lead arsenate, 10 per cent.
	Nicotine sulphate, 1 per cent.
Formula 3	Powdered sulphur, 90 per cent.
Dust	Powdered lead arsenate, 10 per cent.
	Nicotine sulphate, 3 per cent.
Formula 4	Liquid lime-sulphur, 1 part.
Liquid	Water, 9 parts.
Spray	Nicotine sulphate, ¾ pint per 100 gallons.

Formula 4 was modified by diluting the liquid lime-sulphur at the rate of 1 part to 33 parts of water for the 2nd, 3rd and 4th treatments which were applied to the foliage, and 3 lbs. of powdered lead arsenate, per 100 gallons, was added.

The plan of that portion of the orchard where the experiments were conducted, showing the location of the plots and trees, is reproduced in figure 5.

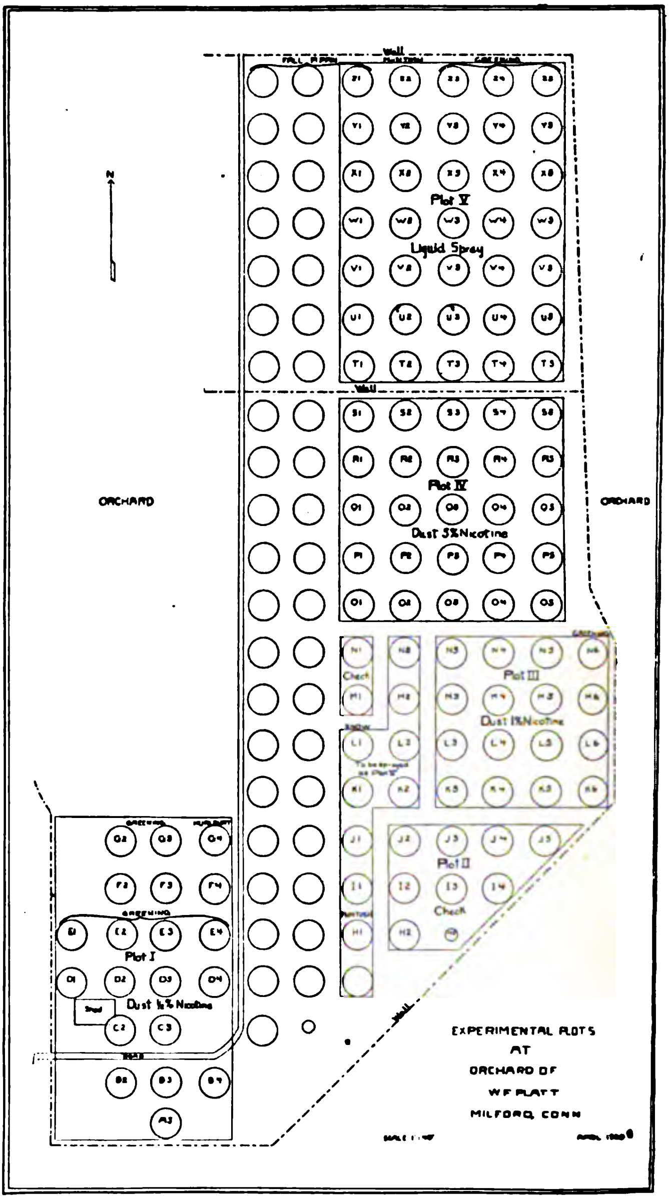

Figure 5. Plan showing arrangement of experiment plots, in orchard of W. F. Platt, Milford, where experiments in dusting and spraying were conducted.

As to varieties, most of the trees were Greening; plot I had 18 Greening and 2 Hurlburt trees; plots II and III were all Greening; plot IV contained 15 Greening, 5 McIntosh and 5 Fall Pippin; plot V contained 21 Greening, 7 McIntosh and 7 Fall Pippin. In all, 104 trees were included in the experiment, and the remaining portion of the thirty acre orchard was sprayed by the owner with a weaker lime-sulphur (1 part to 66 parts of water), but at about the same time and in the same manner as plot V, and was available for collecting data and making observations.

This paper concerns only the treatments and their effects on the insect pests of the orchard. The effect on apple scab and other fungous diseases will be treated separately elsewhere by the Botanical Department.

The treatments given the trees on the different plots were as follows:—

TREATMENTS APPLIED.

Plot I.	Dust, Formula 1..............	20 trees.
Plot II.	Check. No treatment........	8 "
Plot III.	Dust, Formula 2.............	16 "
Plot IV.	Dust, Formula 3.............	25 "
Plot V.	Liquid Spray, Formula 4.......	35 "
		104 trees.

Additional trees in rows adjoining plots II and III on the west were sprayed like plot V, with two trees saved as checks, to obtain data regarding effect on apple scab, by the Botanical Department.

The applications were made on the following dates:.

1st Application	Delayed Dormant	April 22.
2nd "	Pre-pink	May 11
3rd "	Calyx	June 2
4th "	Young fruit	June 25

FIRST, OR DELAYED DORMANT TREATMENT.

Arrangements were completed to make the first application on the morning of April 22. It had rained all of the day preceding, and the trees were moist but not dripping. It was cloudy on the 22nd, with a gentle breeze from the northwest. The treatment began about 8 o'clock A. M., and was finished about 12.30. Messrs. Zappe, Stoddard and Porter made the application. The leaf buds showed a little green at the tips and green apple aphids had hatched and were present on the buds. The trees appeared to be well covered with dust. Living green apple aphids were observed partly covered with dust, about three hours after applying. Rain fell the following day.

For this treatment about 55 lbs. of formula 1; 60 lbs. of formula 2; 75 lbs. of formula 3; and about 150 gallons of formula 4 were used.

This first treatment was followed by cold weather and cold rains which retarded the normal progress of growth for this season of the year.

SECOND, OR PRE-PINK TREATMENT.

The second treatment was made on May 11. At this time the very foremost blossom buds began to show pink, but the others did not. The leaves were only partly developed, but enough so to catch and hold the dust and spray. The weather was ideal for making the application; it had rained a little the day before and it was still and partly cloudy. The work commenced about 8 A. M., and by 9.30 the dusting was finished. The spraying was finished about 11.20. About 4 P. M., a light rain set in which continued during a part of the night.

We ran out of materials of formula 3, before finishing plot IV, and used a little of formula 2, in order to finish. For the spray mixture liquid lime-sulphur was diluted at the rate of 3 gallons, with 3 lbs. of powerded lead arsenate for each 100 gallons. About 225 gallons of the liquid spray mixture were used in this treatment.

The applications were made by Messrs. Zappe, Porter and Stoddard. Very few aphids were present even on the untreated trees. No red bugs had yet appeared and the apple leafhopper, *Empoa rosae* Linn. was just beginning to hatch.

On May 12, a visit to the orchard revealed the fact that the dust was not appreciably washed off by the rains, and though it had collected in low places, or along the mid-rib, or at the tip, was still abundant on the leaves. No injury could be detected on any of the sprayed or dusted trees.

On May 17, another visit was made to the orchard. Bud worms were at work and there were only a few aphids present. Lady beetles were present in moderate numbers.

On May 25, visited orchard again. Greening trees were in full bloom and a few petals beginning to fall. There seemed to be more green apple aphids present than at any preceding visit and a few winged ones were seen. Only one nymph of the false red bug *Lygidea mendax* Reut. was seen, though in the orchard of F. N. Platt, perhaps a mile distant, they were rather common, and most of them were in the second instar.

THIRD, OR CALYX TREATMENT.

This was made on June 2. The petals had all fallen except here and there a late flower remained. Began dusting about 7:30 A. M. It was quite still with a slight southwest breeze. Material was applied by Messrs. Zappe, Porter and Stoddard.

On June 4, visited the orchard. A light shower came on the afternoon of June 3, but it did not seem to wash off the dust. Found five red bugs in 3rd instar, one of which had left the terminal leaves and was on a cluster of four young apples, each of which had been punctured several times. One colony of rosy aphid was noticed on one of the sprayed trees; green aphid had nearly all disappeared.

Visited orchard on June 8. Could not find any red bugs. A few leaf-eating larvae were found, dead. Also visited the orchard of F. N. Platt, and found plenty of red bugs on one tree in northwest corner of the orchard next to a piece of woodland. There was a bug on nearly every terminal shoot, and some of the bugs were already on the fruit clusters and beginning to puncture the young apples which were then about the size of small marbles. These bugs were in the 4th instar.

Fourth, or Young Fruit Treatment.

This was the final application and was made on June 25. There was a light breeze from the northwest. Apparently it required about four pounds of dust per tree, and about 300 gallons of the spray mixture was used. For this application the dusting machine was towed about the orchard with a Ford truck. Messrs. Zappe, Porter and Stoddard did the work. The McIntosh apples were about an inch in diameter at this time. A little of the rosy apple aphid was noticed, but red bugs were scarce. Leafhoppers (*Empoa rosae* Linn.) were present. In afternoon, visited F. N. Platt's orchard and found red bugs just transforming to the adult stage.

Messrs. Britton and Zappe visited orchard on July 2. There were many nymphs and adults of apple leafhopper present causing whitish spots on the leaves. Also visited F. N. Platt's orchard. Most of the red bugs had gone and only a few adults were seen.

General Seasonal Appearance of Trees.

There was little if any difference in appearance between the sprayed and dusted trees during the early part of the season. Both treatments controlled the leaf feeders in a fairly satisfactory manner. Now and then we found the bud worm at work on the tender terminal leaves. The check or untreated trees were not in such good condition though they were not eaten badly.

A slight difference became noticeable late in the season, for at harvest time the dusted trees seemed to have matured or ripened up earlier and had shed more leaves than the sprayed trees. Thus the sprayed trees were slightly greener. This applied to the foliage rather than to the fruit. No injury from any of the applications was noticed during the season. Nearly all of the trees produced fruit.

Scoring and Counting the Fruit

In order to obtain definite and accurate results on the effect of the treatment it was necessary to count and examine the fruit for insect injuries from a certain number of trees in each plot. We attempted to select count trees from the center of each plot. Such trees would be less likely to be affected by the treatments given adjoining plots, because the dust and spray will sometimes be blown upon nearby trees. The following number of count trees were selected in each plot: plot I, 4 trees; plot II, 8 trees; plot III, 4 trees; plot IV, 8 trees, and plot V, 8 trees.

As most of the fruit falls which is badly injured by insects it was thought desirable to gather and score the dropped fruit as well as that remaining at harvest time. The drops from the count trees were therefore gathered about once each fortnight, counted, examined for insect and fungus injuries and a record kept. As the Fall Pippin and McIntosh apples matured earlier than the Greening, they were gathered and examined before the Greenings were harvested. On September 30, a few days before harvest time a severe storm took off a large proportion of the apples and these were also picked up, counted and scored separately.

It is interesting to note that the percentage of apples which were brought to the ground from the count trees by this storm varied considerably in the different plots as the following table shows:

FRUIT REMOVED BY STORM SEPTEMBER 30.

Plot.	No. Count Trees.	Percentage fruit dropped.	Treatment.
I	4	8.3	Dusted ½% nicotine.
II	8	25	Check No treatment
III	4	30	Dusted 1% nicotine
IV	8	23	Dusted 3% nicotine
V	8	17	Sprayed

On account of plot I being in the corner of the orchard, it was unquestionably somewhat protected by the nearby woodland trees and by the packing shed which stands amongst the trees of this plot. It is also on slightly lower ground than any of the others with the possible exception of plot II. With the exception of plot I, the sprayed trees (plot V) lost a slightly smaller proportion of fruit from the storm than the other plots.

The picking was done mostly by Mr. Platt's men, and the counting and scoring was done by Messrs. Porter, Alden, Stoddard, Graham, Zappe, Walden, Garman and Britton.

The dropped fruit was gathered four times for scoring and counting, on July 7, July 23, August 9, and August 30. The Fall Pippins were harvested September 10-15, and the McIntosh and Greening apples were harvested soon after October 1, the work being finished on October 13. This work involved the counting, separate handling, examination, and making record of each, of 159,668 individual apples.

Results of Treatments.

The results of the experiments might be given in detail as concerns each of the principal insect pests occurring in the orchard and attacking the fruit, but they are summarized in the accompanying table. It should be noted that the sum of the percentages for each treatment does not equal 100, because the records of percentages for fungous diseases are not included in this table, and even if they were included, in most cases the percentages would total more than 100 because some fruits showed marks indicating that more than one pest had attacked them.

Statistics of Results.

Treatment.	Total No. of Apples.	Good per cent.	Red Bug per cent.	Aphis per cent.	Codling Moth per cent.	Curculio per cent.	Other Insects per cent.
Check.......	34,273	38.6	7.5	.85	4.77	21.00	5.3
Dusted:							
½% Nicotine.	20,290	60.8	7.1	2.31	.306	19.8	7.4
1% Nicotine.	23,972	86.5	2.05	2.82	.505	6.7	6.8
3% Nicotine.	44,486	82.6	1.66	.795	.398	5.25	4.5
Sprayed.....	36,647	88.0	1.66	1.665	.326	7.45	4.54

Discussion of Results.

It should be borne in mind that these tests represent only one season's work in one locality, and that quite different results might be obtained if the experiments were continued over a period of several years, or if duplicated in a number of orchards in different sections of the state. However, they are given here for what they are worth, and with certain reservations which are noted, may serve as a guide for future work. The percentage of good fruit was somewhat greater on the sprayed trees (plot V) than on any of the dusted trees though those containing one per cent., and three per cent. of nicotine (plots III and IV) were not very far below. The check or untreated trees gave only 38.6 per cent. of good fruit. The results as applied to the chief insect pests of the orchard are as follows:

Red Bug.—This insect was rather scarce in this orchard in 1920, but its injury was detected here and there throughout the orchard and the bugs were seen on a number of occasions. In all cases it was the false red bug *Lygidea mendax* Reut. The figures show that there was little difference between the sprayed trees (plot V) and those treated with one per cent. or more of nicotine in the dust (plots III and IV) but both those having less than one per cent. nicotine in the dust (plot I) and the check or untreated trees (plot II) gave more than three times as much red bug injury on the fruit as each of the other three plots.

Aphids.—Both the green apple aphid, *Aphis pomi* DeGeer, and the rosy aphid, *Anuraphis malifoliae* Fitch · (*Aphis sorbi* Kalt.) were present in the orchard but not in sufficient numbers to make them very destructive. No doubt they were somewhat held in check by the cold and rainy weather during the first half of the summer, and also by the lady beetles which were present. The percentage figures in the table as applied to aphids, appear to have no value, as the untreated trees (plot II) had less aphid injury than any of the other plots except that having three per cent.of nicotine in the dust (plot IV).

Codling Moth.—The codling moth *Carpocapsa pomonella* Linn. was held in check satisfactorily by both liquid spray and dust. Even the untreated trees (plot II) showed less than five per cent. of injured apples.

Curculio.—There was a large amount of injury (21 per cent.) attributed to the plum curculio, *Conotrachelus nenuphar* Herbst., on the untreated trees (plot II), and on the dusted trees containing only one-half of one per cent. of nicotine (plot I) it was only slightly less or 19.8 per cent. As it is a question if nicotine is of any value in controlling this pest and as the trees in plot I were treated with lead arsenate like those in plots III and IV, where the injury was less than one-third as great, some factor other than the treatment must be considered if an explanation is found. The trees of plot I surrounded the packing shed, and were separated only by a stone wall from a pasture partly covered with a growth of brush and some wood had recently been cut there. Possibly these conditions may have furnished better hibernating quarters for the beetles than obtained in the close vicinity of the other plots. The untreated trees (plot II) were only slightly nearer plot I, than was plot III, but it was on the southeast corner of the orchard. A stone wall extended along one side, not only of this plot, but also plots III, IV, and V, in which there was little difference in the amount of curculio injury.

Other Insects.—This category contains minor injuries by chewing insects which could not with reasonable certainty be attributed to codling moth or curculio, though it is possible that both these pests contributed. By far the major portion was due to gnawing of the fruit rather late in the season by Lepidopterous larvae, of which the bud moth *Tmetocera ocellana* Schiff., the lesser apple worm *Enarmonia prunivora* Walsh, and the red banded leaf-roller *Eulia velutinana* Walker, were recognized. The first was reared. There is practically no difference between the plots in regard to this kind of injury, but we believe that it might have been reduced considerably by one or two late applications. (See Plate VI, a).

RECOMMENDATIONS.

It would be unfair to draw final conclusions from these tests of a single season in one locality, and it is hoped that more work may be carried on the coming summer. We cannot advise orchardists to discard their spray outfits to take up dusting, though it is apparently possible to hold the chewing insects in fairly satisfactory control by the use of the dust treatment.

With the addition of nicotine solution some of the sucking insects, particularly false red bug, seem to have been checked, but the data are too meager upon which to base conclusions. The nicotine makes the dusting mixture very much more expensive.

The chief advantage of dusting over spraying is in the saving of time and labor. The disadvantage is in the cost of the materials and apparently this more than offsets the saving in time and labor, as the approximate cost of one treatment per tree was fully three times as great for dusting as for spraying.

If varieties are grown which are not susceptible to scab, and if sucking insects are not troublesome, dusting may give good results, but if these pests are serious in the orchard, better control will probably be obtained by spraying,—a method which has been in common practice long enough so that we know its possibilities. So many experiments have been conducted, that there is an abundance of data to show the value of spraying.

Probably new and more efficient, and possibly cheaper dust mixtures will be devised, but until that time the Connecticut orchardist may as well continue to spray.

Our experience in 1920, not only in Mr. Platt's orchard, but from observations in other orchards, leads us to advise strongly one or two additional and later treatments, in order to forestall the injury from codling moth larvae and other chewing insects late in the season.

NOTES ON THE LIFE HISTORY OF THE FALSE APPLE RED BUG IN CONNECTICUT.

Lygidea mendax Reuter.

BY M. P. ZAPPE.

During recent years this insect has become quite a serious pest in some of the Connecticut apple orchards. It is rather local in its appearance and consequently the injury which it causes is also local. During the summer of 1920, it caused considerable damage to both foliage and fruit in certain orchards. See Plate VII.

The eggs of this species are laid in the lenticels of the apple twigs and hatch at the time when the earliest blossom buds begin to show pink at the tips; most of the buds do not show any color at this time.

When first hatched the young nymphs crawl to the tip of the twig and begin to puncture the young tender leaves which at this time are about one inch long and there are an average of four uncurled ones on each cluster. In a short time the punctured leaves show reddish spots and the sides curl upward. See Plate VII, a.

When the nymphs are in the third instar a few of them begin to leave the terminal twigs and go to the fruit to feed, but the majority of the young bugs do not leave the terminal shoots until they reach the fourth instar. At this time the apples are about the size of marbles. The nymphs when disturbed have the curious habit of dodging around to the back or opposite side of the leaf or twig. After they become winged they drop readily, spreading their wings as they drop. As a rule they do not fly far, usually alighting on a nearby branch. They do not live long as adults. Out of doors they were transforming to the adult stage on June 25, and on the 2nd of July very few adults could be found. Mating and oviposition were not observed.

MOULTS.

This insect passes through five moults before it reaches the adult stage. The length of time varies with the weather. The spring of 1920 was rather cold and backward and it took an average of 37 days from the time the eggs hatched until the adult stage was reached. The first newly hatched nymphs were seen on May 22 and the first adults on June 28.

First Instar. One day after hatching.

Color, carmine*, eyes darker red, with white margins. Antennae darker than body except last segment which is lighter. Legs colorless, rather transparent, and covered with small black spines. Beak colorless except tip, which is black. Black spot on middle of dorsal part of abdomen between third and fourth segments. Head with median groove. Dark oval pattern on dorsal part of thorax with median line running through the center. Abdomen one-third wider than thorax. Length 1.8 mm; width across thorax .33 mm; width across widest part of abdomen .66 mm.

Second Instar.

Abdomen not so wide in comparison to length but still a little wider than thorax and a little darker. Eyes much darker than rest of insect with paler margins. Legs darker than first instar. Black oval pattern of thorax seen in first instar is gone. Thoracic segments darker at edges Length 2 mm; width across thorax .5 mm.

Third Instar. Resembles second instar.

Body covered with fine white pubescence which becomes darker a few hours after moulting. Tylus black, antennae and legs darker than rest of body. Length 2.5 mm; width .87 mm.

Fourth Instar.

Wing pads appear in this stage and extend to cover the sides of the first abdominal segment. A deep fovea on each side of middle of second thoracic segment. Length 3.5 mm; width 1.33 mm.

Fifth Instar.

Wings in this stage extend to the sixth abdominal segment. Posterior third of wings and tip of abdomen dusky, also a dark line on the sides of the scutellum. Length 4 mm; width 2 mm.

Sixth Instar.

Adult stage. Bright orange red, antennae and narrow bar across the base of pronotum, black. Clavus, inner angles of corium, and membrane, fuscous; in dark specimens the scutellum and all but the narrow margin of the hemelytra fuscous; legs greenish yellow with fuscous on the tibiae. Length 6 mm; width 2.33 mm. The adult is shown on Plate VII, a.

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*Windsor and Newton's water colors in Smith's Explanation of Terms Used in Entomology.

CONTROL.

This insect may be controlled by spraying the trees just before the blossom buds open. Nicotine solution, 1 pint to 100 gallons of water, will hold the insect in check, especially if the tree can be sprayed from both sides at once. If only one side is sprayed at a time the young bugs have a chance to go to the opposite side of a leaf or twig and dodge the spray. This spraying may be combined with what is commonly known as the "pink spray,," which consists of arsenate of lead and commercial lime and sulphur.

As all of the red bugs probably will not be killed at this time, nicotine should be added to later sprays, especially the first calyx spray, soon after the petals fall.

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NOTES ON THE LIFE HISTORY OF A SAWFLY FEEDING ON AUSTRIAN PINE.

Itycorsia zappei Rohwer.

BY M. P. ZAPPE.

On June 23, 1915, while collecting insects in New Haven, near some Austrian pines, a large sawfly was taken that looked different from anything in the Station collection. A special effort was made to collect a few more specimens which were flying around Austrian pines.

Several of these specimens were sent for determination to Mr. S. A. Rohwer of the Bureau of Entomology, who is a specialist in this family. He pronounced them an undescribed species of the genus *Itycorsia,* which he afterward named *zappei.* In the Proceedings of the U. S. National Museum, No. 2312, Vol. 57, page

209, Mr. Rohwer published the descriptions of both sexes of the adults.

The next summer larvae were found feeding in small silken webs on the new growth of the Austrian pines. The writer suspected that these larvae might have some connection with the adults that had been present on the trees, so a number were collected and reared. The following summer adults emerged and proved to be the same as those captured from the trees.

THE EGG.

The eggs are laid singly on the needles of the new growth late in June and early in July. They are about 4 mm. long and are of a pale clay yellow color. They are crescent-shaped and are laid lengthwise on the needle, being fastened at the back. Both ends are up-turned and pointed, one tapering a little more than the other. When the young larva hatches it emerges from the end which tapers the least. See Plate VIII, a.

THE LARVA.

First Instar.

Length about 3 mm., body greenish yellow, first thoracic segment with a black marking extending from middle of one side to middle of opposite side with a black spot at each end. A black crescent-shaped mark at base of each leg. Two elongated black spots between each pair of legs on ventral surface of thorax. Legs black. Cerci at end of body with three segments, two distal segments black. Head rufous with appendages lighter. Antennae black with white rings at joints, last segment pointed at tip. Eyes black. Body covered with minute hairs. The eleventh segment bears a pair of atrophied prolegs.

Second Instar.

Length 6 mm. Head light brown with appendages black. Body greenish yellow, legs black. A narrow black stripe extends from base of first pair of legs to under side of head. Other markings same as in first instar.

Third Instar.

No change in markings or other characters from preceding moult.

Fourth Instar.

Head orange brown. Crescent-shaped marks at base of legs not so distinct except on first segment which still shows plainly though not so distinct as in preceding instar. Body becoming more or less glabrous except anal segment which has a number of rather long hairs.

Fifth Instar.

Markings above base of legs gone. Color of body darker green than in preceding instars except head and the first three segments and last two segments which are brownish. First segment has a dark brown bar on the dorsal surface.

Sixth Instar. (See Plate VIII, b.)

Larva entirely green except head which is still brown. There is a dorsal stripe of green darker than rest of body. In this instar the larvae stop feeding and go into the ground where they hollow out a small cell and pass the winter. In the late spring they transform to pupae and emerge as adults about the latter part of June.

The feeding period of the larva is just about one month.

HABITS OF THE LARVA.

When the young larvae hatch from the eggs they begin to spin a loose web around themselves, fastening the outer threads to the needles. As the larvae reach full size these webs are often four to five inches long and the larvae move up and down inside them by wriggling the body. The larvae have no prolegs and when removed from their webs and placed on a smooth surface, are unable to crawl until they have spun a sort of a web over themselves.

Their method of feeding is rather interesting. They usually begin at the top of their web and with their strong jaws bite off a needle at its base, just above the bundle sheath, very much as a cut-worm cuts off a plant. Then they proceed to eat it, beginning at the cut off end until they have devoured the entire severed needle. Then they take the next one. They have never been observed to leave their web and go to another twig. The larva in its case is shown on Plate VIII, c, and an empty case at d, of the same Plate.

THE ADULT.

In order to bring together in one publication the descriptions of all stages of this insect, the original descriptions of the adults as published by Rohwer, in the Proceedings of the U. S. National Museum, Vol. 57, page 209, 1920, are given below.

Itycorsia sappei Rohwer.

"Of the North American species, this new species is probably most closely allied to *maculiventris* (Norton), but the male differs in a number of ways from the description given for that species, and the description of the female given by MacGillivray does not agree in all details with the female of the species described here. In MacGillivray's key to the species of *Itycorsia* of Connecticut (Bull. 22, Conn. Geol. and Nat. Hist. Survey, p. 33) this species runs to couplet 6, but differs from both *luteomaculata* (Cresson) and *albomaculata* (Cresson) in the black cypeus and other minor characters. Of the European species it seems to be more closely allied to *stellata*, but differs from the descriptions of that species in the color of both adult and larva."

"Female.—Length 13 mm. Anterior margin of the clypeus truncate; medianly the clypeus is strongly raised by the extension of the antennal carina; its surface is shining, impuncate; median fovea deep, elongate; area above the frontal crest with rather close, small punctures; median ocellus in a diamond-shaped depression; posterior ocellus bordered laterad and caudad by a deep furrow; posterior orbits and vertex shining, with large widely separated punctures, frontal crest obsolete; antennae 31-jointed, the third joint slightly longer than the fourth and fifth combined; prescutum shining, practically impunctate; scutum shining, with a median area of close, large punctures; scutellum shining, practically impunctate; mesepisternum subopaque, with sparse, rather large, setigerous punctures. Black; spot on the mandibles at base, spot on the superior orbits, two spots on the vortex, spot on the occiput behind the eye, and with a line-like projection toward the supraorbital spot, the posterior margin of the pronotum, tegulae, two spots near the posterior margin of the prescutum, two spots along the notauli on the scutum, two large spots on the scutum posteriorly, a small spot on the lower posterior orbits, an elongate spot on the mesepisternum dorsally, circular spot on the sides of the pronotum, most of the metepisternum, dorsal and ventral margins of tergites, the apical margin of the sternites 3, 4, 5, and 6, yellowish-white; legs black; the tibiae and basal joints of the anterior tarsi rufous; wings hyaline basally, fuliginous beyond the basal margin of the stigma; venation dark brown."

"Paratype females show that this species may vary as follows: the spot on the metepisternum may be greatly reduced; the line projecting toward the supraorbital spot may be complete or entirely absent; the yellow spot on the lower margin of the posterior orbits is usually wanting."

"Male.—Length 8.5 mm. In puncturation and characters of the head, the male agrees with the above description of the female, except the declivous face is a little more sharply defined on the frontal crest, however, the frontal crest is rounded and not margined; antennae 31-jointed; the third joint slightly longer than the fourth and fifth; hypopygidium broadly rounded apically. Black and yellow; antennae yellowish-ferruginous, apical half brownish; scape above black; head black; mandibles except apices, clypeus except two points medianly, lateral supraclypeal area, area between the antennae and extending caudad in two lines to the level of the anterior ocellus, the lateral orbits near the top of the eye where they narrow and extend almost to the middle of the occiput, supraorbital spot, connected with the line extending posteriorly to meet the line of the occiput, two spots on the vertex, yellow; thorax black, the posterior dorsal margins of the pronotum, tegulae, most of the prescutum, two spots on the scutum anteriorly, spots on the scutum posteriorly, the scutellum, most of the metepisternum, sternum, metepimerun, and episternum, yellow; sternites, and tergites ventrally, and the lateral margin of the tergites dorsally yellow; the rest of the tergites black; legs yellow with the base of the coxae posteriorly, line of the femora and trochanters posteriorly black; wings hyaline; venation dark brown; costa and also margin of the stigma yellowish."

"Type Locality.—New Haven, Connecticut. Described from eight females and two males collected by M. P. Zappe for whom the species is named. The type female was collected as a larva August 2, 1916, on Austrian pine and emerged June 7, 1917. It is recorded under No. 670 Connecticut Agricultural Experiment Station. The type male and the paratype male were collected as larvae on August 2, 1916, on white pine, and emerged June 26, 1917, and are recorded under No. 669 Connecticut Agricultural Experiment Station. The other females were collected in June and July, 1915."

"Type, Allotype, and four female Paratypes.—Cat. No. 21605, U. S. N. M."

"Three female paratypes and the male paratype returned to the Connecticut Agricultural Experiment Station."

TESTS OF SOAP SPRAYS TO KILL THE PINK AND GREEN POTATO APHID.

Macrosiphum solanifolii Ashmead.

By M. P. Zappe.

During the summer of 1920 there was a local outbreak around New Haven of the pink and green potato aphid which has done considerable damage during the last three or four years. At Woodmont there was a rather heavy infestation in two large fields of about sixty acres of potatoes. The owner came to the Station for advice. He did not wish to spray unless it was absolutely necessary. In one of the fields there were large numbers of parasites and parasitized aphids present, also many lady-beetles and their larvae. A fungous disease was also present and had killed quite a large number of the aphids, consequently it did not seem worth while to spray the potatoes in this field. In the other field, however, the infestation on the Green Mountain variety was rather heavy, and though parasites were also present, they were not nearly as abundant as in the first field.

It was decided to spray the second field and keep a close watch on the other. The usual spray of nicotine solution and soap was recommended, but on account of the scarcity of labor the owner wished to avoid the task of dissolving the soap. But if he did have to dissolve soap, he felt that he might better use a little more soap in the spray and omit the nicotine solution (which had advanced in price from $10.75 to $13.75 per ten pound package).

Soft soaps were suggested and a cheap kind of soft soap was procured at one and one-half cents a pound and tried on a small scale. A chemical analysis showed the soap to be 93 per cent. water with a very large excess of free alkali. There was so much free alkali that it would burn one's hands. This soap proved to be of little value for killing aphids even when used as strong as one part soap to two parts water.

Another soft soap which was intended for washing automobiles was tried with much better results. This soap was a better grade of soap than that just mentioned. It was made with a linseed oil base and contained only 56.2 per cent. of water. This soap cost twenty-five cents a pound wholesale in twenty-five pound pails. When used at the rate of one-half ounce to one gallon of water, this soap was 100 per cent. effective in killing the aphids on dipped potato plants. Part of the second field of potatoes was sprayed with this soap with very good results. The sprayer was of the four-row type with three nozzles to each row. The lower nozzles could be turned up at any angle desired so that the underside of the leaves could be easily sprayed. See Plate VI, b.

Still another brand of automobile soft soap was tried. This was claimed by the dealer to be just the same as the soap described above, but the price was much higher (thirty-eight cents a pound in five pound pails) and it was not nearly so effective in killing aphids. To get the same result, over twice as much soap had to be used.

THE EUROPEAN RED MITE, A NEW ORCHARD PEST IN CONNECTICUT.

Paratetranychus pilosus Can. and Fanz.

Order Acarina Family Tetranychidae

By Philip Garman.

A number of Connecticut orchardists observed with no little concern during the past season, the damage caused by the European red mite. Most of them had little success with the ordinary insect control measures which consisted for the most part of lime-sulphur, nicotine and lead arsenate preparations applied in accordance with the usual spray calendar recommendations. In consequence, it is important to state what is known of the habits and control of the mite under local conditions as well as to indicate what measures have been successful for similar troubles in other localities. Considering the fact that the pest is often mistaken for others less injurious, it is also important to describe its structure and indicate characters for its recognition. These facts together with a history of the pest in Connecticut will form the present statement regarding the European red mite.

Discovery in Connecticut.

About July 2, 1920, Doctor Britton, State Entomologist, visited the orchard of Mr. Frank N. Platt, of Milford. He noted there a tree which had brown leaves, and thought from appearances, that the red spider (*Tetranychus bimaculatus* Harvey) was responsible. Examination of leaves brought by him to the laboratory showed them to be infested with the European red mite, a species not hitherto reported from Connecticut. Examination of material brought from Milford earlier in the season by Mr. Zappe led to the suspicion that there was something different in hand, but the pest was identified from material obtained later. Referring then to the Experiment Station collection of unidentified mites, a single slide was found which contained the same species. This was collected by Mr. Zappe at Clintonville, in the town of North Haven, April 17, 1917. Eggs were also received in the fall of 1919 on a small peach twig. These were allowed to hatch and a comparison of the larvae with those obtained later showed that they are the same.

Distribution.

The above observations indicate that the European red mite has been in Connecticut at least three years. During the last year it has been found in Greenwich, Danbury, Milford, Branford, Wallingford, Middletown and Meriden. It is reported from Canada (Ontario), Pennsylvania, and is thought to occur in New

Jersey. Probably it has a much wider distribution and has in many cases been mistaken for the red spider (*Tetranychus bimaculatus* Harvey) or the clover mite (*βryobia pratensis* Garman).

DESCRIPTION.

Adult mites are dark velvety red in color, the young somewhat brighter. The eggs are dull red.

The egg is slightly flattened above, is radially grooved and has a short stalk arising from the center, the stalk being slightly longer than the vertical diameter of the egg. It measures .15 mm. in diameter when fresh. See figure 6, 2, and for appearance of eggs on twig, Plate IX, b.

The larval and nymphal stages are similar to the adult female in general appearance; but are smaller in size and the larva has only three pairs of legs instead of four.

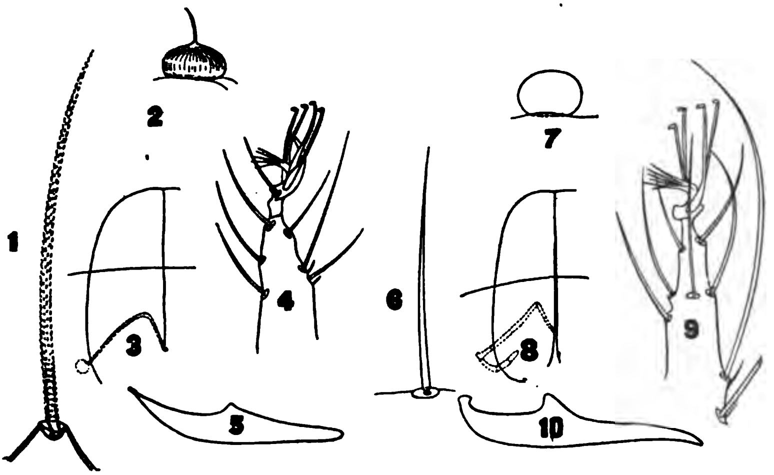

Figure 6. Structures of European red mite *Paratetranychus pilosus* Can. and Fanz. and common red spider *Tetranychus bimaculatus* Harvey.

1, *Paratetranychus pilosus*, seta of dorsum 846 times enlarged; 2, egg, 14 times enlarged; 3, collar trachea and mandibular plate, 714 times enlarged; 4, tarsus of first pair of legs of female, 921 times enlarged; 5, penis, 1400 times enlarged.

6, *Tetranychus bimaculatus*, seta of dorsum, 846 times enlarged; 7, egg, 14 times enlarged; 8, collar trachea and mandibular plate, 714 times enlarged; 9, tarsus of first pair of legs of female, 921 times enlarged; 10, penis, 1400 times enlarged.

The adult female is about .31 mm. in length. There are 26 setose dorsal bristles arising from small tubercles (see figure 6, 1) which when viewed with a lens of small magnifying power appear as white dots. The tarsi, or last segment of the legs, is provided with a single claw, widest at the mid point and with apparently five (there are probably six) appendiculate spurs projecting at right angles (see figure 6, 4). There are also four tenent hairs with hooked tips arising from the base of the claw and exceeding it considerably in length. The mandibular plate (see figure 6, 3) is similar to that of most other red spiders, but the collar

trachea consists of a simple tube suddenly dilated at the tip to form a nearly spherical chamber. The maxillae consist of about four segments, each of which is tipped with a short spatulate body probably representing an additional one. The next to the last segment has a strong hook, and the last has five setae (two apical, two basal on the dorsum, and one lateral) and a clavate hair between the two dorsal pairs.

The male is much smaller in size and the tip of the abdomen is more pointed than in the female. The male genitalia of the different species of red spiders are characteristic of each.

Probably the most closely related representative of the red spider family is the west coast mite, known as the citrus red spider (*Paratetranychus citri* McGregor[1]). This mite does similar damage to fruit trees in Oregon and differs from the European red mite only in minute characters of the male genitalia, and the mandibular plate. The egg, however, seems to have a longer central stalk and the guy fibrils reported on the citrus mite egg have not been seen in the egg of the European red mite.

There are abundant differences, however, between the European red mite and the ordinary red spider (*Tetranychus bimaculatus* Harvey). The dorsal hairs are smaller (see figure 6, 1 and 6), the collar tracheae are different (see figure 6, 3 and 8) and the tarsi lack the large claw (see figure 6, 9). The male genitalia are also different (see figure 6, 5 and 10.)

The only other mite which seems to be confused in the minds of some is the clover mite (*Bryobia pratensis* Garman) which, however, bears little resemblance. The clover mite has a much wrinkled skin, is usually purplish or brown in color, and bears around the margin of the body a number of small flat movable plates. There are also two claws on each tarsus instead of one and the front pair of legs is much longer than any of the others. The eggs are larger, measuring .20 mm. in diameter, and lack the radial grooves and central stalk.

Habits and Life History.

The European red mite passes the winter in the egg stage. Large numbers are laid in the fall on twigs from the size of a lead pencil to three-fourths of an inch in diameter. They are frequently found several layers deep about bud scars or in crevices in the bark. Apples are also selected for egg laying, the eggs being frequently placed in the calyx cavity as shown on Plate IX, b. Here they are protected from being rubbed off in handling and are doubtless carried from place to place in the shipment of fruit. Under favorable conditions they may hatch, and regain a host, thus starting a new colony.

Emergence takes place early in the spring though the exact time cannot be stated for this locality. In Sweden the eggs of the same mite hatch about the first of May and young mites were observed in 1920 about this time in Connecticut. From then on they develop rapidly if conditions are suitable, and several generations probably develop before the winter eggs are laid. In 1920, they became much reduced in numbers on the leaves about the first of August, and very few could be found, although numerous cast skins were present on the leaves. The greatest development therefore took place between May and August (in 1920) and it is probable that most damage was done in June. The different stages consist of a larva, three nymphal, and the adult stage. Eggs, larvae, nymphs and adults may be found on the leaves at the same time so that there appears to be no definite brood limits.

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[1] = *mytilaspidis* Riley.

The European red mite spins little or no web. Larvae spin more than adults, but they never produce as much web as the common red spider.

Observations in Various Orchards.

The first extensive leaf injury was seen in Plant Brothers' Orchard, Branford, Connecticut. Here a large block of Baldwin was affected, the leaves having turned brown and the injury being visible as far off as the orchard could be seen. A block of Greening in the same orchard appeared to be untouched, but examination of the leaves showed that there were a good many mites present. Doubtless there is some difference in the vitality of the two varieties, the Greening being better able to withstand injury. In this and other orchards injury from mites was seen on Baldwin, Ben Davis, McIntosh, and Hurlburt, but in nearly every case the Baldwin showed the effects of infestation more than other varieties.

Infested trees lose some of their foliage and the size of the fruit is affected. Examination of Baldwin fruit in the Plant Brothers' orchard, selected from injured and uninjured trees of approximately the same age and size, showed a marked reduction in the size of apples from the injured trees. One Baldwin tree observed in the orchard of Mr. Frank Platt, near Milford, had almost no marketable apples. (See Plate IX, a.)

An effort was made to determine what sprays were used in orchards showing the worst injury. The Plants' orchard proved to be the most instructive, and showed that attention must be given to early sprays, especially the delayed dormant application. This spray apparently should not be diluted more than 1 to 9 in the case of lime-sulphur, and should be applied with great care to cover as much of the tree as possible.

Recommendations of Other Investigators.

Sulphur in some form is usually recommended for control of red spiders. Sulphur dust is said to require an average temperature of 75° F., (7, page 523*,) in the shade, to be effective, but just how it kills is not well understood. It is thought that it vaporizes at this temperature and that the fumes do the work; and it apparently acts only at short range.

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*See literature at the end of the article.

Lime-sulphur solution is more frequently recommended, the dilute strength (1-50) being necessary for summer use. It is said to kill by contact, but it is slow in doing its work, and acts over a considerable period of time. The self-boiled mixture is recommended by some (4, page 34), and the addition of flour-paste to dilute lime-sulphur by others (6). Kerosene emulsion (8, page 208) and Scalecide are also encountered in recommendations for red spider control.

In Oregon (2, page 87), one of the most effective controls appears to be afforded by a combination of nicotine sulphate and lime-sulphur or scalecide. It is thought that the eggs are not killed by winter strength lime-sulphur, but observations on the citrus mite indicate that the continued action finally kills a large per cent. of the mites, after hatching.

TABLE I

LABORATORY TESTS OF VARIOUS INSECTICIDES ON THE EUROPEAN RED MITE

Material Used.	Number killed.	Number alive.	Per Cent. killed.	Examination after.	Date.
Sulphur dust......	1	12	7.6	6 hrs.	July 28
" "	1	18	5.2	24 hrs.	July 28-29
" "	19	45	29.6	48 hrs.	July 28-30
Lime sulphur 34° Bé 1 gal.-43¼ gals...	7	6	53.8	6 hrs.	July 28
"	17	3	85.0	24 hrs.	July 28-29
"	79	28	73.8	48 hrs.	July 28-30
Borax Soap 2 lbs.,- and 40% Nicotine Sulphate ¾ pint 50 gals..........	15	3	83.3	6 hrs.	July 28
"	26	1	96.2	24 hrs.	July 28-29
"	114	5	95.7	48 hrs.	July 28-30
Borax Soap 6 lbs.- 50 gals.........	33	0	100.0	6 hrs.	July 28
"	20	2*	90.9	24 hrs.	July 28-29
"	141	6	95.9	48 hrs.	July 28-30
Borax Soap 4 lbs.- 50 gals.........	23	2	92.0	12 hrs.	July 28-29
Amalie Auto Soap 4 lbs.-50 gals.....	15	5	75.0	12 hrs.	July 28-29
6 lbs.-50 gals.....	12	5	64.1	12 hrs.	July 28-29
Check No. 1......	3	21	12.5	6 hrs.	July 28
"	5	21	19.2	24 hrs.	July 28-29
"	55	321	14.6	48 hrs.	July 28-30
Check No. 2......	1	29	3.3	12 hrs.	July 28-29

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*Young larvae recently hatched.

Material used.	Number killed.	Number alive.	Per Cent. killed.	Examination after.	Date.
Fels Naphtha Soap					
4 lbs.-50 gals.....	18	0	100.0	6 hrs.	July 28
"	15	0	100.0	24 hrs.	July 28-29
Star Soap					
4 lbs.-50 gals.....	21	0	100.0	6 hrs.	July 29
"	23	2	92.0	24 hrs.	July 29-30

TABLE II

RESULTS OF FIELD TESTS IN THE PLANT BROTHERS' ORCHARD
Branford, Conn.

Treatment.	Killed.	Alive.	Per Cent. killed.	No. of trees used.
Soap 4 lbs.-50 gals...........	125	139	47	24
Soap 2 lbs. and 40% Nicotine Sulphate 1 pint-50 gals.................	69	75	48	24
Check.....................	66	119	36	24
Dust 90% Sulphur 10% Arsenate of lead 3% Nicotine sulphate	No difference could be seen between check and treated blocks.			35

All treatments in Table II were made July 28, 1920.

Welcome borax soap was used, and Black Leaf 40. Dusting was done about noon. The counts were made by selecting twigs at random from trees in the center of the block and examining with a binocular. The examination was made August 5, and also several weeks later. No counts were made at the later date.

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THE APPLE AND THORN SKELETONIZER IN CONNECTICUT.

Hemerophila pariana Clerck.

This is an European species which has recently become established in this country. It first appeared in Westchester County, N. Y., and its presence in the United States was mentioned by Doctor E. P. Felt in a Scientific Note in the Journal of Economic Entomology, Vol. 10, page 502, August 1917. Later a full illustrated account giving habits, descriptions, partial life history and bibliography appeared in the Thirty-third Report of the New York State Entomologist for the year 1917, and it is from this publication that the chief facts were gleaned for use in the present paper.

Doctor Felt had warned us to be on the watch for the insect in Fairfield County, Connecticut, because he had observed it very near the Connecticut border in Westchester County, N. Y., but the first report of its occurrence within the state was made over the telephone in the autumn of 1920 by Mr. F. A. Bartlett of Stamford, who stated that the insect was quite abundant in the vicinity of Belle Haven, Greenwich. At my request he gathered some material and sent for examination. This reached the laboratory November 13. From Doctor Felt's published descriptions, we were able to identify it as *Hemerophila pariana* Clerck. On November 18, Messrs. Walden and Zappe of this department visited the locality and gathered more material from which an adult moth emerged on December 7. According to Mr. Bartlett, the insect occurs in the towns of both Greenwich and Stamford. Belle Haven is situated in the southwestern part of Greenwich adjacent to the town of Rye, N. Y.

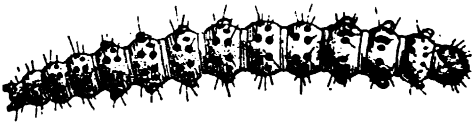

Figure 7. Larva of apple and thorn skeletonizer, six times enlarged. (After Felt, Cornell Extension Bulletin 27, 1918.)

NATURE OF INJURY.

The caterpillars feed upon the upper surface of the leaves sometimes entirely skeletonizing them, but often leaving a portion untouched at each margin at the base of the blade. Each larva spins a light web over the center of the leaf, curling the leaf upward and drawing together the margins especially toward the tip. The extent of injury varies from only slight feeding to entire skeletonization and is shown on Plate X, a.

The leaves are not webbed together like the nests of the fall web-worm. In the worst infested sections of Westchester County, N. Y., some of the unsprayed orchards are completely defoliated.

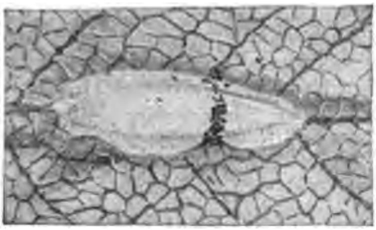

Figure 8. Cocoon of apple and thorn skeletonizer on leaf, twice natural size. (After Felt, Cornell Extension Bulletin 27, 1918.)

DISTRIBUTION.

According to Doctor Felt, this insect has been recorded from England, France, Germany, the Balkan Peninsula, Bithynia and western Asia including Turkestan.

In America it is known to occur only in Westchester and Rockland Counties in the State of New York, and in Greenwich and Stamford, Fairfield County, in Connecticut It is not known how long the insect has been established in the United States or how it was introduced here, but the probabilities are against rapid dissemination, though its range in Europe and Asia indicates that the insect may be able to maintain itself over a greater portion of the United States and southern Canada.

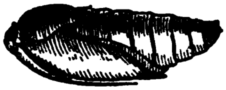

Figure 9. Pupa of apple and thorn skeletonizer, six times enlarged. (After Felt, Cornell Extension Bulletin 27, 1918.)

LIFE HISTORY.

The life history has not been completely worked out in this country, but the data collected by several entomologists in Europe indicate that there are at least two and probably three generations each year. It is thought that the insect passes the winter in both the adult and pupa stages, the former in any shelter, and the latter in the cocoon on the leaf. Doctor Felt reports much variation in the development of the insect at Irvington, N. Y., as very small and full-grown larvae were both found together in September and early October. Probably the larval or feeding stage lasts from four to six weeks. As injured leaves seem to be rather uniformly distributed over the tree and throughout the orchard, it is suggested by Doctor Felt that the moths may deposit a few eggs near the base of each leaf. Particularly when abundant, the moths seem to oviposit on nearly every leaf.

In Europe the adults are found on the flowers of the Compositae, especially goldenrod.

Though the insect shows a preference for apple, the list of food plants in Europe includes also pear, hawthorn or thorn, mountain ash, birch and possibly willow. Several Hymenopterous parasites have been reported by European writers and one, *Dioctes obliteratus* Cresson, has been reared in New York State.

DESCRIPTION.

Larva:—Length nearly one-half inch when full-grown, greenish-yellow in color with black, tubercular spots varying greatly in size and bearing hairs. Head amber, with irregular dark-brown line at the lateral dorsal angle adjoining the first thoracic segment. Antennae yellowish brown, legs pale yellow.

Pupa:—Length, about one-fourth of an inch, rather stout, dark bronzy yellow, head dark-brown. The white silken cocoon is about five-eighths of an inch long and one-fourth of an inch broad, fastened to the upper surface of the leaf, frequently along the mid-rib. The pupa can be seen faintly, and before the moth emerges, wriggles partly out from the cocoon, the pupal shell often projecting from it. (See Plate X, b.)

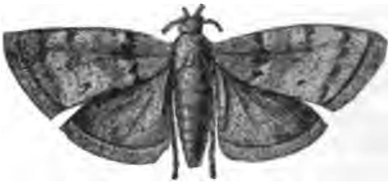

Figure 10. Adult of apple and thorn skeletonizer, four times enlarged. (After Felt, Cornell Extension Bulletin 27, 1918.)

Adult:—Wing-spread of slightly less than half an inch, grayish-brown to dark brown usually with purplish tinge, fore-wing marked with a rather broad broken angulate dark band near basal third, and another less distinct but more regular dark band crossing the wing near the distal fifth. Area between these bands is grayish but variable in color, and usually marked by one or more dark spots near the costal margin. The head, thorax and abdomen are covered with dark brown scales shading into or mottled with yellowish-brown or purplish-brown and quite variable. Rear wings dark fuscous. Both wings margined with purple fringe. Under side lighter with two whitish spots on costal margin of fore-wings.

Illustrations of the larva, cocoon, adult moth and the injured leaves are shown in figures 7-10 and on Plate X, a. and b.

CONTROL MEASURES.

As the larvae feed upon the upper surface of the leaf, timely and thorough applications of lead arsenate will probably readily control this pest. It may be necessary to spray rather late in summer in order to check the late brood. It is reasonably certain that such measures will forestall injury in orchards, where the owners make a practice of spraying, but there are so many neglected trees throughout Connecticut that there is great danger that the insect will subsist upon them and gradually become distributed all over the state. If all trees in and around the infested region could be sprayed in this manner, it would be an effective check on the spread of this insect.

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THE SINUATE PEAR BORER.

Agrilus sinuatus Olivier.

This European beetle causes serious injury to pear trees in France and Germany, and was first discovered in this country in New Jersey in 1894. Apparently it was introduced in nursery stock. It seems to have spread rather slowly and in 1915 Doctor Felt* reported that the insect was known to occur in several localities in New York State. The first indication of its occurrence in Connecticut was on May 29, 1917, when we received from Mr. G. S. Brown, Norwalk, a piece of bark from a pear tree which seemed to show the work of this insect, and a note to that effect was printed in the Station Report (1917, page 361). On a visit to Stamford on June 24, 1920, the writer examined a small pear orchard on Strawberry Hill, where many of the trees were attacked, injured, and some of them seriously deformed by this insect. According to Mr. F. A. Bartlett of Stamford, considerable injury has been noticed by him in the pear orchards in Stamford and Greenwich.

Mr. H. B. Weiss† in 1914, reported the insect as being present in Essex, Union, Middlesex and Bergen Counties in New Jersey, and states: "While it is true that it is not abundant every year, it is customary to run across its work in the northern part of the state. In spite of the fact that it is no longer destructive, it is evidently holding its own in a small way and spreading somewhat."

All varieties of pear are infested. The Bártlett seems to be preferred, and the Keiffer, though attacked, is not seriously injured.

CHARACTER OF INJURY.

The larva, which is one of the flat-headed borers, makes a long narrow and winding burrow under the bark chiefly in the sapwood.

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*Report of the Entomologist of New York, 31, page 78, 1915.

†Journal of Economic Entomology, Vol. 7, page 251, 1914.

These burrows are rather conspicuous, especially in young trees having a smooth bark. The nearly-grown larvae make burrows which are much larger than those made by the first-season larvae and consequently they are more conspicuous. Trees of all ages are attacked and injured. Small trees are sometimes girdled and killed by intersecting burrows, and large trees are weakened and sickly often losing branch after branch, and finally die. Many instances were noticed where the galleries had killed the bark on one side of a branch while the other side appeared healthy.

LIFE HISTORY AND HABITS.

The adult beetles appear late in May and during June, and deposit their eggs in the crevices of the bark. These eggs hatch in early July and the grubs begin their sinuous tunnels which are very narrow at first but gradually increase in diameter as the grubs grow. On the approach of winter, the grub stops feeding and rests in its burrow until spring, then continues its work. The second summer the grubs are much larger and of course the burrow corresponds in size. The zigzag or sinuous course which is downward is very pronounced. The bark over the burrows is somewhat depressed, blackened and often cracked, so that an infested tree can usually be recognized at a glance. Smith* states that in no case has he ever seen a complete girdling by a single larva, but where two or more larvae happen to work in the same branch, their galleries often meet and if a small branch or a small tree, it may result in a complete girdling and that part above the injury dies. This is more apt to happen the second season than the first. In September of the second season the larva eats its way into the wood about one-fourth of an inch and makes a cell or enlarged burrow lengthwise the stem. At the opposite end of this cell the grub eats its way to the bark and plugs both ends of its cell with sawdust. In this chamber it passes the winter, gradually contracting in length, and pupating in the cell the following April. The location of this pupal cell is visible in young trees or in the smaller branches of large trees, as the bark is somewhat sunken and blackened, the blackening extending into the wood and probably being due to a fungus. The beetle then emerges through a semicircular hole in the bark.

According to Doctor Felt† the studies of Doctor H. Glasgow of the New York Agricultural Experiment Station at Geneva, N. Y. show that the beetles feed readily upon the foliage. This habit may make it possible to control the pest by the use of arsenical sprays applied late in May or just before the beetles emerge. The adults are found flying about on sunny days or resting upon the bark of the trunk or branches.

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*New Jersey Agricultural Experiment Station Report for 1894, page 558.
†Report New York State Entomologist, 31, page 79, 1915.

DESCRIPTION.

Larva:—Length, about one and one-half inches when full-grown; very flat, white or yellowish, head small and brown, with prominent mandibles. The first thoracic segment is much enlarged about twice as broad as the abdominal segments and having somewhat the appearance of a large head, but flattened like the other segments; first five abdominal segments have parallel sides, but second and third thoracic and last three abdominal segments have rounded or angular sides which are not parallel.

Adult:—Length, about one-third of an inch, breadth about one-fifth of its length, slender like the other Buprestid beetles belonging to the genus *Agrilus*. In color it is bronzy brown, shining, but with the surface granulated and punctured.

Both larva and adult have the appearance shown in figure 11.

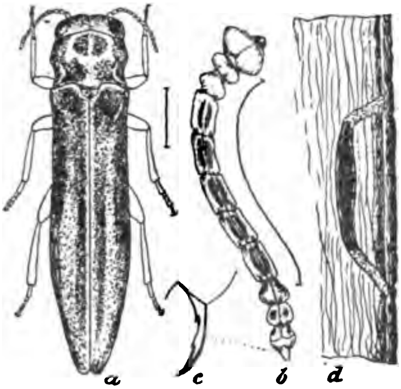

Figure 11. Sinuate pear borer. *a*, adult beetle; *b*, larva; *c*, anal fork of larva; *d*, pupal cell in solid wood—all enlarged. (After Smith, Report New Jersey Agricultural Experiment Station for 1894.)

CONTROL MEASURES.

All trees infested to such an extent that their value has been destroyed should be cut and burned. The worst infested branches or portions of a tree may also be pruned off and burned. In certain cases the pupal chamber as indicated by the sunken and discolored area may be cut open and the insect destroyed with the knife.

If the foliage be kept covered with arsenate of lead during the latter half of May and June, no doubt many of the adults will be killed in feeding upon the leaves.

Possibly washes of lime-sulphur and arsenate of lead applied to the bark before the beetles emerge may repel them so that they will seek other trees on which to oviposit, but this cannot be ascertained except by a long series of careful experiments.

The trees should be well fertilized and kept in a vigorous and growing condition, as they will not be so soon overcome by the attacks of this insect.

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THE EUROPEAN CORN BORER.

Pyrausta nubilalis Hubner.

An account of this insect will be found in the Reports of this Station for 1918, page 316, and for 1919, page 170. Since the latter Report was published the infested areas have been extended by the discovery of new towns found infested in Massachusetts, New Hampshire and in New York.

Besides this additional territory in the United States, two new infested centers have been discovered in the Dominion of Canada, in Welland County, Ontario, and also in Elgin, Middlesex County, and a part of Oxford County in western Ontario.

SCOUTING IN 1920.

Early in 1920, we received from the Bureau of Entomology at Washington the record of shipments of broom corn imported from Austria a few years ago, and consigned to two broom factories in Connecticut, one at Thompsonville in the town of Enfield, and the other at New Hartford. On April 26, Messrs. Zappe and Walden visited New Hartford and examined the cornstalks and stubble in eight fields around the factory. On April 29 they visited Thompsonville and inspected ten cornfields in the vicinity of the factory. No traces of the European corn borer were found in either case.

Members of the department staff have during the year examined many corn fields in different parts of the state, and have investigated many complaints and reports regarding borers in corn. As a rule these reports apply to the stalk borer *Papaipema nitela* Guen., or to the corn ear worm *Heliothis obsoleta* Fabr. (See Report for 1919, pages 180 and 188 respectively) both of which were quite abundant in 1920 as well as in 1919.

So far the European corn borer has not been found in Connecticut, and none of the appropriation of $10,000.00 made by the

General Assembly for the suppression of this insect should it occur here, has been expended.

STATE QUARANTINE.

The Federal Horticultural Board established Quarantine No 43, against the European corn borer, under date of March 15, 1920. In the Report of this Station for 1918, page 323, was published the text of the first quarantine order issued by Connecticut under authority granted by Section 2106 of the General Statutes, the quarantine bearing the date of September 20, 1918. As this order applied only to shipments of corn from the infested section of eastern Massachusetts, and as portions of New Hampshire, New York and Pennsylvania had been found infested after the establishment of the quarantine, a revised order was issued as Quarantine Order No. 3, effective June 1, 1920, prohibiting shipments of plants liable to be infested from all known infested areas in the United States, as follows:—

STATE OF CONNECTICUT
OFFICE OF
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

Quarantine Order No. 3.

Effective June 1, 1920.

Whereas a very destructive insect, known as the European Corn Borer *Pyrausta nubilalis* Hubner, exists in certain portions of the States of Massachusetts, New Hampshire, New York and Pennsylvania, and threatens the corn growing industry of the country; and whereas there is grave danger that this insect may be brought into this State by the transportation of infested plants or parts of plants from the infested area:—

Therefore, pursuant to the provisions of Section 2106 of the General Statutes, it is hereby ordered that no corn on the ear, stover, or other parts of the corn plant, broom corn, including all the parts of the stalk, celery, green beans in the pod, beets with tops, spinach, rhubarb, oat and rye straw as such or when used in packing, cut flowers or entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, and cut flowers or entire plants of gladiolus, and dahlia, except the bulbs thereof, without stems, shall enter Connecticut from the infested areas mentioned below, unless each shipment, car, box, bale, or package bear a valid certificate issued by an authorized Federal inspector, stating that the contents thereof have been examined and found free from infestation by the European Corn Borer. These restrictions do not apply to dry shelled kernels or cooked and preserved products, or products grown in non-infested territory passing through infested areas in transit.

INFESTED AREAS.

Massachusetts: Barnstable, Bourne, Brewster, Dennis, Eastham, Falmouth, Harwich, Orleans, Provincetown, Sandwich, Truro, Wellfleet, Yarmouth, in Barnstable County; Amesbury, Andover, Beverly, Boxford, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuen, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Saugus, Swampscott, Topsfield, Wenham and West Newbury in Essex County; Arlington, Bedford, Belmont, Billerica, Burlington, Cambridge, Carlisle. Chelmsford, Concord, Dracut, Everett, Framingham, Lexington, Lincoln, Lowell, Malden, Medford, Melrose, Natick, Newton, North Reading, Reading, Somerville, Stoneham, Sudbury, Tewksbury, Tyngsboro, Wakefield, Waltham, Watertown, Wayland, Weston, Wilmington, Winchester and Woburn in Middlesex County; Avon, Braintree, Brookline, Cohasset, Holbrook, Milton, Quincy, Randolph, Wellesley and Weymouth in Norfolk County; Abington, Brockton, Duxbury, Hanover, Hanson, Hingham, Hull, Kingston, Marshfield, Middleboro, Norwell, Plymouth, Pembroke, Rockland and Scituate in Plymouth County; Boston, Chelsea, Revere and Winthrop in Suffolk County.

New Hampshire: Kingston, Plaistow and Seabrook in Rockingham County.

New York (Eastern): Albany, Cohoes, Colonie and Guilderland, in Albany County; Johnstown and Perth in Fulton County; Amsterdam, Florida and Mohawk, in Montgomery County; Brunswick, North Greenbush and Troy, in Rensellaer County; Ballston, Charlton, Clifton Park, Galway, Malta, Milton, Saratoga Springs and Stillwater in Saratoga County; Glenville, Niskayuna, Princetown, Rotterdam and Schenectady, in Schenectady County; Esperance in Schoharie County. New York (Western): Dayton, Perrysburg and Persia, in Cattaraugus County; Hanover, Pomfret, Dunkirk and Sheridan, in Chautauqua County; Brant, Collins, Cheektowaga, Eden, Evans, Hamburg and North Collins in Erie County.

Pennsylvania: North Girard in Erie County.

The regulations of this quarantine order are subject to modification to include additional territory, if such is found infested and in general will be interpreted as conforming to, rather than as being at variance with the regulations of the Federal Horticultural Board.

Quarantine order No. 1 relating to this insect, and issued September 20, 1918 is hereby revoked.

This order shall take effect June 1, 1920.

Approved.
M. H. HOLCOMB,
Governor.

E. H. JENKINS,
Director Connecticut Agricultural
Experiment Station.

Since issuing this Quarantine Order, No. 3, the following new towns have been found infested with the European corn borer:—

Massachusetts: East Bridgewater, Wareham, Whitman, Lakeville and West Bridgewater in Plymouth County; Canton, Dedham, Needham and Medfield in Norfolk County; Maynard, Westford, and Sherborn in Middlesex County; New Bedford in Bristol County.

New Hampshire: Hampton, North Hampton, Portsmouth and Rye in Rockingham County.

New York: Mayfield and Broadalbin in Fulton County; Glen and Charlestown in Montgomery County; Knox in Albany County; East Greenbush, Poestenkill and Schaghticoke in Rensselaer County; Duanesbury in Schenectady County; Middleburg, Schoharie and Wright in Schoharie County; Amherst, East Hamburg, West Seneca and Tonawanda in Erie County; Arkwright, Portland, Villenova, and Westfield in Chautauqua County.

The Federal Horticultural Board has issued four amendments to Quarantine No. 43, to cover these additional infested towns, the fourth bearing the date of October 23, 1920.

THE PEAR AND CHERRY SLUG.

Caliroa cerasi Linn.

The presence of brown slimy slugs or snail-like larvae is often noticed, feeding upon the upper surface of the leaves of pear and cherry. The green tissue may be eaten in patches or over the entire leaf, only the skeleton and lower epidermis remaining. Not infrequently small trees in nurseries and newly-set orchards are completely defoliated.

The author of this mischief is a small sawfly known as the pear or cherry slug, *Caliroa cerasi* Linn., sometimes listed as *Eriocampoides limacina* Retzius. It is an European species which feeds upon a large number of different plants in Europe. It has been known in this country for more than two centuries but here attacks chiefly pear and cherry.

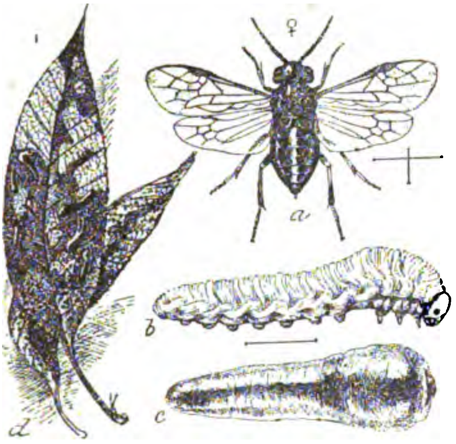

Figure 12. Pear and cherry slug. *a*, adult sawfly, female; *b*, larva with slime removed; *c*, larva in normal state; *d*, leaves and larvae, natural size; *a*, *b*, *c*, much enlarged. (After Marlatt, Circular 26, Division of Entomology, U. S. Department of Agriculture.)

In Connecticut there are two generations each year, the eggs for the first being laid about the middle of May. The eggs are laid in the leaf from the under side, and by means of the ovipositor a cut is made between the lower epidermis and the upper epidermis, and also through the latter around the place where the egg is deposited. These cut places may be seen from the upper side and appear like small blisters. In each blister an egg is laid. The eggs hatch in about two weeks, and the young larva which is at first white, escapes through a crescent-shaped cut to the upper surface and soon becomes covered with a brownish slime or coating which it carries until the last moulting stage. (See figure 13.)

The larva is much enlarged in the thoracic portion from which the abdomen tapers toward the tail giving it somewhat the appearance of a "bull-head" or tadpole. These brown slimy creatures are much wrinkled transversely, and present a very disgusting appearance. They pass through five stages: at the last moult, the brown slimy covering disappears and in the fifth or final larval stage, the slugs are yellow. They are now through feeding and soon go into the ground two or three inches and make cells in the soil in which they transform within six to eight days. The adults emerge in about ten days and soon lay eggs for the next generation. A part of the first-brood larvae do not transform but remain unchanged in their cocoons in the soil until the following spring. The eggs for the second brood are laid in July and August, and it is this brood which causes most of the injury in Connecticut.

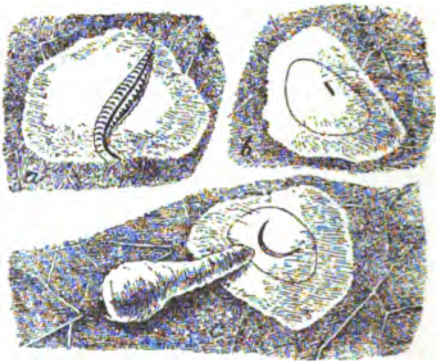

Figure 13. Pear and cherry slug, showing method of ovipositing and emergence of larva: *a*, cutting of cell with ovipositor beneath epidermis; *b*, the same after egg has been deposited; *c*, the same after emergence of larva—all enlarged. (After Marlatt, Circular 26, Division of Entomology, U. S. Department of Agriculture.)

Though there are usually two generations each year in the northern states, there are said to be three generations in the latitude of Washington, D. C.

This species is parasitzed by a minute four-winged fly, but so far as known this parasite has not been reared in Connecticut.

The adult of the pear and cherry slug is a small sawfly, 6 mm. in length, with black head, body, legs and antennae. The wings are smoky with black veins. (See figure 12.)

The specimens in the Station collection are from New Haven and South Windsor, but it is reasonably certain that the species occurs throughout the state. Larvae or characteristic injury have been received from Hartford, West Hartford, Southington, Meriden, Wallingford, Norwich, Old Mystic, and South Norwalk. Our nursery inspectors have observed this insect in many other places in the state.

As regards remedies, spraying with lead arsenate will prove the most satisfactory in the nursery and orchard. The larvae may be killed, however, by spraying or dusting the leaves with fresh hellebore. Dusting with air-slaked lime or even with fine road dust will suffocate many of them.

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THE CURRANT STEM GIRDLER.

Janus integer Norton.

A brief account of this insect appeared in the Report of this Station for 1896, page 238, recording its occurrence in Windham in that year. But as this Report has long been out of print, and as the insect has been observed many times and in many places since, it is mentioned here. It was also received from Meriden in 1920. Mr. Zappe examined a currant patch at Norwood, Hamden, on June 6, where nearly every twig had been severed by this insect.

The adult is one of the sawflies (Order Hymenoptera) and a slender species about half an inch in length. Both sexes have black head and thorax. The male has a brownish-yellow abdomen, but basal half of the female abdomen is reddish-orange and distal or posterior half, black.

The female punctures the soft tender shoot of the currant, by means of a saw-toothed ovipositor, and places a yellowish egg in the pith. This egg is elongated oval in shape. Above the egg the shoot is girdled by means of a series of transverse cuts with the ovipositor. The girdling usually occurs about three-fourths of an inch above the egg, but the distance may vary from half to an inch.

The stem is usually not cut entirely, but wilts and soon breaks off, leaving the stubs. Some of the tips break off and fall at once. The injury is shown in figure 14, and on Plate XII, a.

The egg hatches in about eleven days, and the larva feeds on the pith, excavating a tunnel seldom over six inches long, and packing if full of excrement in the rear. About the first of September the larva becomes full grown, hollows out the lower end of its burrow, and gnaws its way outward to the bark. In this enlarged chamber, the larva encloses itself in a silk cocoon in which it passes the winter. In the spring the larva changes to a pupa and the adult emerges during the latter half of May. The adult, larva and pupa are shown in figures 15 and 16.

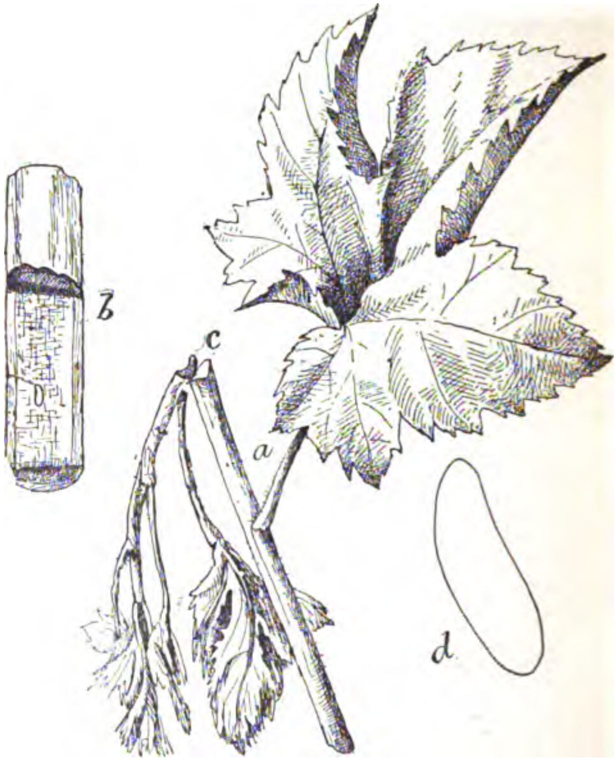

Figure 14. Currant stem girdler: *a*, egg puncture; *b*, section of stem showing egg in pith; *c*, severing of terminal shoot by female; *d*, egg — greatly enlarged. (After Marlatt, Insect Life, vols. vi and vii, Division of Entomology, U. S. Department of Agriculture.)

This insect was first described in print by Norton* under the name of *Cephus integer* in 1861, but the following year Fitch† published a description of the same species under the name of *Janus flaviventris*. Writers have used the name of *Phylloecus integer* and *P. flaviventris*, but according to the rules of priority

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*Proc. Boston Soc. Nat. History, Vol. VIII, p. 224.

†Seventh Rept. on Insects of New York, p. 852.

Norton's name stands, and from the latest accepted scheme of classification, the insect belongs in the genus *Janus*.

In Connecticut this insect has been collected or observed in Windham, Canaan, New Haven, Hamden, Cheshire, Meriden, New London, Greenwich and Hartford. Undoubtedly it occurs throughout the state.

The currant stem girdler is probably a native of North America where it formerly bred in wild currants. Now it attacks the cultivated species, especially *Ribes rubrum*, often causing considerable injury. In nurseries and where the wood is used for cuttings the insect is considered more of a pest than in fruiting plantations.

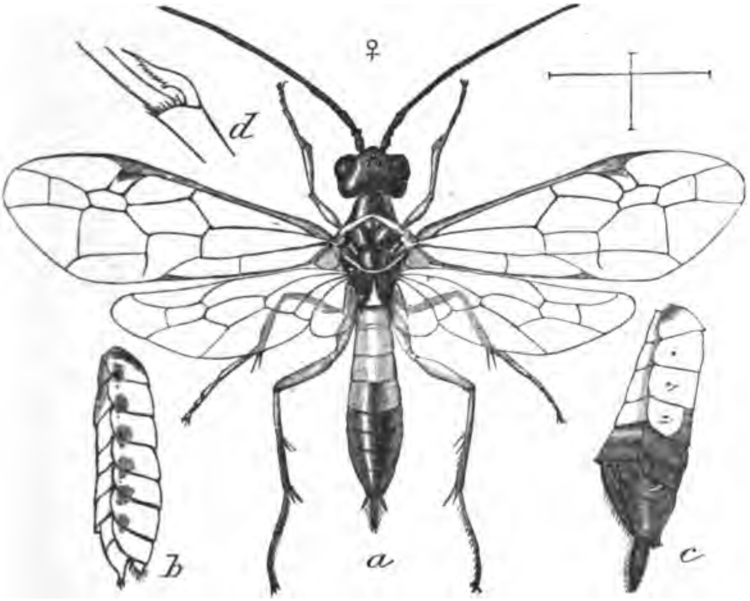

Figure 15. Currant stem girdler: *a*, adult female; *b*, lateral view of male abdomen; *c*, lateral view of female abdomen; *d*, apex of anterior tibia of female—all greatly enlarged. (After Marlatt, Insect Life, vols. VI and VII, Division of Entomology, U. S. Department of Agriculture.)

About the only remedial measures to be recommended are those of gathering and burning the tips containing the insect. If the girdled canes are cut back one or two inches in June, the tips will drop to the ground, soon become dry and the newly hatched larvae will be destroyed. Failing to do this, the tips of the infested canes can be gathered and burned in the fall or early spring. If these measures are practiced thoroughly for a few seasons, the injury will be much lessened.

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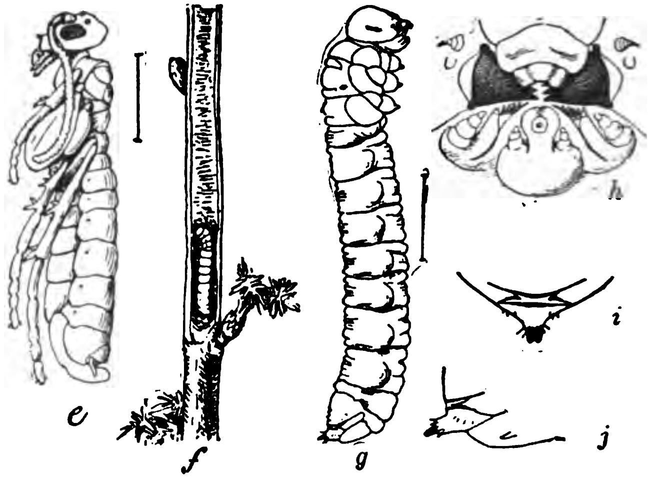

Figure 16. Currant stem girdler: *e*, pupa; *f*, larva in twig; *g*, larva; *h*, mouthparts of larva; *i*, dorsal view of tip of abdomen; *j*, lateral view of same—all enlarged. (After Marlatt, Insect Life, vols. vi and vii, Division of Entomology, U. S. Department of Agriculture.)

THE CELERY CATERPILLAR OR FENNEL WORM.

Papilio polyxenes Fabr. (*asterias*).

A yellowish-green caterpillar, more or less prominently marked cross-wise with black is often seen feeding upon the leaves of celery, carrots, parsnip, parsley, fennel, or in fact almost any plant of the family Umbelliferae. Though never very abundant, one often finds several of these caterpillars on a short row in the garden. Sometimes they are quite destructive to young plants, especially celery.

Few observers recognize this caterpillar as the larva of the common black swallow-tail butterfly which may be seen here and there, everywhere, at certain periods of the season.

The eggs are one millimeter in diameter, globular, smooth, and yellow changing to reddish-brown. They are laid on the upper side of the leaves of the host plants, and hatch in about ten days. At first the young caterpillar is black with the rear end white, and a white band across the middle, but it moults five times and after each moult has a somewhat different appearance. When fully grown it is about two inches in length, green with the front margin of each segment black enclosing six yellow spots. When disturbed, this caterpillar pushes out from the prothorax just back of the head, two hornlike scent organs and a disagreeable odor may be noticed. These organs are probably for defense. The appearance of the caterpillar is shown on Plate XI, a.

A period of between three and four weeks is required for the larva to reach maturity and during this time it devours its food plant. Then it suspends itself to a leaf, stem, fence or other object of support which happens to be in the vicinity. The pupa is brown marked with black and dark green and is attached by a button of silk at the tail and by a girdle around the thorax. The insect remains in this state from nine to sixteen days, except when formed late in the season when it passes the winter.

The butterfly has a wing-expanse of between three and four inches, the female being usually larger than the male. Both pairs of wings are black crossed near the outer margin by two rows of yellow spots and a row of yellow lunules on the margin. A broad bluish band occurs between the rows of yellow spots on the rear wings and this color even extends faintly upon the rear margins of the fore wings. As a rule the blue band is more prominent in the female, and the yellow is more pronounced in the male, often appearing as solid bands on the rear wings, but great variations occur. At the inner angle of the rear wings there is an orange spot with a black center. Each of the rear wings bears a black tail-like appendage. Thorax and abdomen are black, marked with yellow spots. Plate XI, b, shows the appearance of this butterfly.

There are two generations in the northern states and at least three in the South. In the North the butterflies emerge in May and June from over-wintered pupae.

The species occurs throughout North America from southern Canada into South America as far as Venezuela and also in the West Indies.

Regarding control measures, hand picking is the usual and best method for the home garden. In large fields of carrots or parsnips where the tops are not to be eaten or fed to domestic animals, spraying or dusting with lead arsenate may be practised in case the insect appears in great numbers.

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THE GRAPE BERRY MOTH.

Polychrosis viteana Clemens.

The chief cause of wormy grapes in Connecticut is this insect which occurs in the eastern portion of the United States and Canada, and westward as far as Illinois. The berries in a cluster are often webbed together, caused by the second-brood larvae leaving one set of berries and going into another. In some New York vineyards injuries are recorded which amount to a loss of from 25 to 50 per cent. of the total crop. In one case even 90 per cent. of the crop was ruined.

The grape berry moth undoubtedly occurs throughout the state; it has been sent to the Station from Sharon, Norwich, Mystic, Clinton and New Haven. It is a native American species and probably infested the wild grapes in this country before any vineyards were planted.

The adult is a small moth, having a wing-spread of slightly less than half an inch, of purplish-brown color, the fore wings marked or mottled with patches of darker brown. Rear wings are smoky-brown shading to whitish at the base.

In New York State the grape berry moth has two complete generations and a partial third one, the winter being passed in the pupa state on the old leaves on the ground. In making this cocoon portions of the leaves are cut and the edges rolled over and a silken case is formed inside the roll.

The moths emerge the first half of June and are thought to lay their eggs on the stems of the blossom clusters. Be this as it may, the first brood of caterpillars are at work at the time the grapes blossom, and make a scanty web among the blossom buds, and feed somewhat upon the buds often destroying a dozen or more in a cluster. They continue to feed during the month of June and also destroy many of the newly-set berries. The caterpillars of the first brood become mature soon after July 1, and make their cocoons by rolling up flaps of the leaves as has been described above. In a period varying from twelve to fourteen days the moths emerge leaving their empty pupa shells projecting from the cocoons. They soon lay eggs on the berries or perhaps some of them on the stems, and the larvae of the second brood gnaw their way into the berries, usually entering near the stem or where two berries touch each other. The infested berries show a dark reddish spot around each entrance hole, and as the larvae feed inside the berries these spots enlarge until perhaps half the berry is discolored. (See Plate XII, b).

The young larva is whitish, with a blackish head, but as it grows the body changes to a dark olive green or brownish color, and often a purplish tinge is apparent. Thoracic shield and legs also become blackish. The larva is active and when disturbed wriggles out of the berries and spins down on a silken thread. The feeding period in the berries lasts about three weeks.

According to Goodwin* two thorough sprayings at the right time and with the proper materials will control this pest and ensure fruit nearly free from infestation. He recommends a Bordeaux mixture made after the 2-3-50 formula, to which four pounds of paste arsenate of lead and two pounds of dissolved soft soap have been added. The first treatment should be made just after the vines blossom, when the young berries are about one-eighth of an inch in diameter. The second application should be made about seven weeks after the first, or just before the eggs have been laid for the second-brood larvae. In Ohio this comes between August 2 and 12, but the exact time may be determined for each locality by placing in a jar about July 20, some wormy grapes with grape leaves on top of the berries: a piece of cheese cloth should be tied over the top of the jar and the jar placed out of doors in the shade. The spray should be applied ten days after the larvae first begin to make their cocoons on the leaves, and for this application six instead of four pounds of paste arsenate of lead should be used.

The vineyard should be intelligently pruned, cultivated, fertilized and sprayed properly for the other insect and fungous pests in order to produce a perfect crop.

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*Bulletin 293, Ohio Agricultural Experiment Station, 1916.

MOSQUITO WORK, SEASON OF 1920.

By S. T. Sealy.

During the season of 1920, a constant patrol has been maintained on all of the drained salt marsh areas in the towns of Fairfield, Orange, New Haven, East Haven, Branford, Guilford and Madison, an approximate total of 5,000 acres. This means that at no time have the drainage ditches been allowed to become clogged or choked for any appreciable length of time. This patrol has kept the water in circulation and the surface drained, thereby reducing mosquito breeding to a minimum. It has also shown the need of supplementary ditches, which we have installed, to take off water which the original ditching did not fully care for.

Except for a few high tides in the fall, the season as a whole has been comparatively dry, making conditions somewhat better for mosquito elimination work than in previous wet seasons.

The mosquitoes which have been most troublesome this season have come, not from the drained marshes, but from adjoining ones where no drainage ditches have been installed, and from the "rain barrel" mosquito which breeds in any standing water about dwellings or in inland pools.

The writer states this as a fact, since he has made it a point to spend one day each week with the men doing the maintenance work in the different towns. At no time has any intensive breeding been found on drained areas. As soon as surface breeding was located it was immediately drained to the nearest ditch.

FAIRFIELD.

The work at Fairfield has been carried on by Mr. Nicholas Matinck with an average crew of two men to assist him. As Mr. Matinck has been engaged in this kind of work for the past few years, his efficient methods have made the Fairfield marshes almost mosquito proof. In addition to the salt marsh work the town officers of Fairfield have authorized and paid for, from town funds, considerable work in the upland sections; such as oiling, draining, and cleaning fresh water streams, brooks, ponds, etc.

NEW HAVEN, EAST HAVEN, ORANGE.

In the towns of New Haven, East Haven and Orange, a crew of four men, part of the time and two men the remainder of the time, have been at work keeping the ditches clean, the outlets free and the water in circulation. This crew started at West Haven and worked around the harbor to East Haven, going over the same route when the circuit was completed.

The tide gates constructed by the City of New Haven at Congress Avenue Bridge have been completed and are doing excellent work. The marsh north of the gates has been dry all the season, thereby eliminating the breeding of salt marsh mosquitoes on this area.

BRANFORD.

The work at Branford has been under the direct supervision of Mr. L. E. Rice. The defective tide gates at Indian Neck have kept the marsh in a very wet condition causing a small amount of breeding in the upper end of the swamp. These gates will be put in repair as soon as it is determined what the state is going to do in regard to road and bridge; as gates are now hung on the bridge it would not be practicable to repair them at present.

A sand bar has formed at the mouth of the creek below the gates, stopping the flow of water. It is planned to remove this obstruction next season.

GUILFORD.

Mr. Frank Blatchley has patrolled and maintained the marshes of Guilford in perfect condition. He also repaired the tide gate at Shell Beach, which was damaged by last winter's storms.

MADISON.

The State Park Commission has maintained the ditches on the state property in good shape and hundreds of feet of new ditches have been installed for mosquito drainage by Mr. Joseph P. Synnott, who was in charge of the work for the Commission. Only a few days this season have visitors at the State Park been annoyed by mosquitoes, and then only when the prevailing winds have been from the east, blowing hordes of mosquitoes over from Clinton.

Mr. Russell Bartlett has had charge of the work in Madison that was not controlled by the Park Commission, and has maintained the marshes in excellent condition. The most trouble was along the beach caused by sand filling the main outlet ditch; this sand had to be dug out very frequently.

NEW WORK.

On June 4, 1920, a contract was let to Eaton, Brown & Simpson, Inc., 90 West Street, New York City, to drain for mosquito elimination sixty acres at Groton Long Point, Connecticut. They installed 28,000 feet of 8 x 20 ditch and built a bridge over the main outlet to the bay, for the sum of $1,000.00, three-quarters of which was subscribed by the members of the Groton Long Point Association.

As there are no other marsh lands in the near vicinity of Groton, the inhabitants are not likely to be troubled with mosquitoes from now on.

On September 14, 1920, at the request of Mr. J. Frederick Jackson, Director Bureau of Engineering, State Health Department, an inspection was made at Lydall's Brook, Manchester, Conn. Light breeding was found in Union Pond and along the brook as far as Fould's Paper Mills. The settling tanks used to catch the waste water from the mills were found to be prolific breeders of mosquitoes (*Culex pipiens*). When these tanks overflow into the brook, the larvae are scattered along all the way to Union Pond, causing the people in the near vicinity to be pestered by mosquitoes. The State Department of Health is working on this matter, and will very likely plan some way to abate this nuisance.

COST OF MAINTENANCE AND NEW WORK, SEASON 1920.

Maintenance:	Madison	$265.63
	Guilford	578.14
	Branford	376.90
	East Haven	68.42
	New Haven	386.95
	Orange	474.66
	Fairfield	1,397.76
		$3,548.46
New Work:	Groton	250.00
Supervision*		2,401.43
Total		$6,199.89

MISCELLANEOUS INSECT NOTES.

Stalk Borer:—The stalk borer *Papaipema nitela* Guen., was present and ruined an occasional stalk of corn and potatoes, but was not nearly so prevalent as in 1919. Specimens were received from Danbury, Ridgefield, Derby, Milford, West Haven, New Haven, Hamden, New Hartford, Middletown and Hartford.

The Bud-Moth Injuring Apples:—One species found injuring the mature fruit in the orchard of Mr. William F. Platt, Milford, was the bud moth *Tmetocera ocellana* Schiff. The dark brown larva occurred with other leaf-rollers, several species of which were feeding upon the surface of the fruit.

Green Clover Worm:—The green clover worm *Plathypena scabra* Fabr., which was so prevalent in 1919 causing injury nearly everywhere throughout the eastern United States, did not injure beans at all in Connecticut in 1920. By making a thorough search in my own garden, I managed to find a few larvae, but the feeding which they did was unnoticeable.

Pine Tube Moth:—The pine tube moth *Eulia pinatubana* Kearfott, mentioned on page 201, and shown on Plate XXXII, of the Report of this Station for 1919, was reported as being rather abundant around Stamford in 1920. Late in the fall three samples were received from Norwalk, Sound Beach and Stamford. If ornamental pines are infested sufficiently to endanger their foliage, or even their appearance the trees should be sprayed with lead arsenate..

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*Supervision includes salary and traveling expenses of Deputy in Charge, first cost, insurance and upkeep of automobile.

Periodical Cicada or Seventeen-Year Locust:—Brood II of this interesting insect was scheduled to appear in 1920 in Suffield and in Tolland, Conn. Several correspondents and entomologists were warned to watch for it, and though they did so, the reports were all negative. I have yet to learn of anyone who collected or observed this insect in Connecticut in 1920.

Corn Ear Worm:—The corn ear worm *Heliothis obsoleta* Fabr., was received from Mystic, Milford, Middlebury and New Canaan. In one field in Mystic about half the crop was damaged. This insect usually attacks late maturing corn, especially sweet corn, and feeds on the soft kernels chiefly at the tips of the ears. Sometimes it works down the side of the ear and eats some of the kernels near the base. It is a much more serious pest farther south than it is in Connecticut. In New Jersey it is controlled by dusting the corn silk with powdered sulphur and dry lead arsenate, equal parts.

Sesiid Borers:—On July 1, 1920, Mr. Zappe visited a garden at 260 Howard Avenue, New Haven, and found apple trees infested with Lepidopterous larvae boring in the branches and doing considerable damage. Some material was brought to the laboratory, and on July 16, an adult clear-wing moth emerged. This proved to be *Sesia pyri* Harris, a species having a wing expanse of less than three-fourths of an inch, and transparent wings with black margins. It rarely causes serious injury, as the larva burrows in the bark but does not penetrate the sapwood.

A similar borer was received, June 11, from the Elm City Nursery Company in a stem of Rhododendron. On June 23, the adult emerged. It is a similar though different species from the preceding, but has not yet been identified.

Oriental Peach Moth:—No larvae of this insect could be found in 1919 by Mr. Zappe, at the place where it infested peach fruits in 1918 near Stamford (see Report of this Station for 1918, page 299) and on June 20, 1920, Messrs. Zappe and Britton in company with Mr. W. O. Filley, Forester of this Station, and Mr. F. A. Bartlett of Stamford, visited the same premises. It is true that some of the trees had died and had been removed and others had been severely pruned. Though there was little fruit to become infested, we examined the twigs of several trees and found no signs of injury. Doctor T. J. Headlee informs the writer that the Oriental peach moth has been unusually destructive in New Jersey the past season.

Red Banded Leaf-Roller:—In harvesting and scoring the fruit in the experiments in dusting and spraying in the orchard of Mr. William F. Platt, Milford, described in the preceding pages of this Report, many of the apples were gnawed on the surface, especially where covered by a leaf or another apple, and in some cases in the stem or calyx cavities. At least three insects were responsible for this injury: (1) the bud moth mentioned on page 176, (2) the lesser apple worm, *Enarmonia prunivora* Walsh, and (3) the red banded leaf-roller *Eulia velutinana* Walker. The last seemed to be the most abundant and the injury was apparently done late in the season. The injury shown on Plate VI, a, was sufficiently serious to warrant another and later treatment to prevent it.

Juniper Scale:—On August 4, 1917, a twig of common red cedar *Juniperus virginiana,* infested with the juniper scale *Diaspis carueli* Targ.-Tozz., was received from Danbury. On March 11, 1920, Mr. A. S. Peterson, New Rochelle, N. Y., sent to the Elm City Nursery Company a branch of a cultivated juniper *Juniperus pfitzeriana,* well infested with this scale. It is a scale with shell nearly circular, and occurs on the leaves sometimes in great numbers, as is shown on Plate XIII, b. The female shell is very convex, gray or dirty white, often covered with a sooty deposit. The male is small, elongated, narrow with parallel sides, with a median ridge or carina, and white in color.

Apparently little is known regarding the life history of this insect, or how best to hold it in check. Probably it will do little harm to trees in their native habitat, but should it infest choice ornamental specimens, it can doubtless be controlled by several applications between June 1 and September 1, of either kerosene emulsion, or nicotine solution and soap, given in the form of a spray.

The Elm Leaf-Miner:—On June 14, elm leaves were received from Miss Charlotte B. Norton, Lakeville, Conn., which showed the characteristic mines and feeding injury of a sawfly known as the elm leaf-miner *Kaliofenusa ulmi* Sundewall. More material was requested and received a few days later. This was placed in the breeding cages and possibly next summer some adults may be obtained. The larvae are miners between the upper and lower epidermal layers of the leaves, and frequently there are several larvae in a leaf and the mines run into each other making a large blister, sometimes involving the entire leaf. These blisters are very conspicuous, showing almost as plainly from beneath as from above, and have the appearance indicated by Plate XIII, a. The badly injured leaves drop, but those slightly injured remain upon the tree, the mined areas falling out leaving holes. In aggravated cases trees are nearly defoliated by July 1, but later new leaves appear and the trees regain their normal appearance. Of course such attacks weaken the trees and render them very unsightly. As is the case with the elm leaf beetle, the European species of elm are preferred to the American elm.

This is the first evidence that the elm leaf-miner is present in Connecticut, though it has been known to injure elms in and around Albany*, N. Y., for more than twenty years. The adult is a small sawfly only three millimeters long, and the eggs are laid in the leaves during the latter half of May and June. There is only one brood each year.

A number of experiments in controlling this insect have been conducted by Professor G. W. Herrick† of Cornell University. He found that when a tree was sprayed thoroughly with 40 per cent. nicotine solution and laundry soap, just as the mines begin to show, all larvae were killed.

Ox Warbles:—On May 15, three larvae were received from Mr. B. K. Allen of Saybrook, with the statement that they had been squeezed from a cow's back. It is not unusual for cattle to have "grubs" under the skin on their backs. The infestation is most noticeable in late winter or early spring, and a series of lumps may be felt or often seen. These lumps increase in size and finally discharge their inmates which go into the ground to pupate and later emerge as two-winged flies, more or less covered with yellow hairs somewhat resembling bees. (See Plate XV, a.) These flies are known as "bot-flies" or "warble flies" and annoy cattle and horses in the pasture in summer, laying their eggs upon the hairs of the legs or body. The eggs are licked off by the animals and taken into the stomach where they obtain nourishment. The larvae of the horse-bot, *Gastrophilus equi* Clark, are attached to the wall of the stomach and when finally mature pass out of the animal with the excrement. But those in cattle make their way through the stomach wall and other tissues, finally reaching the skin upon the back. Two species, *Hypoderma bovis* DeGeer, and *H. lineata* DeVillers, are known to attack cattle and both occur in Connecticut. They cause considerable injury by annoying the animals, and "warbled" hides are much less valuable than perfect ones.

There is no good remedy. Grubs beneath the skin may be squeezed out or treated with mercurial ointment. Where possible it is advisable to keep the animals well cleaned and brushed and to prevent them from licking themselves.

A closely allied species, *Oestrus ovis* Linn., is the well-known sheep-bot, the larva of which infests the nasal cavities in sheep.

Other closely related species belonging to the genus *Cuterebra*, infest rabbits and are occasionally found in cats. On October 2, a large larva was received from Vernon, which had been squeezed from a hole through the skin on the side of a kitten six months old.

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*M. V. Slingerland, Cornell Agr. Expt. Station, Bulletin 233, page 50, 1905.

†*Ibid*, Bulletin 333, page 510, 1913.

A Curious Form of Injury to Dahlias by the European Giant Hornet:—On September 21, two adults of the European giant hornet, *Vespa crabro* Linn., were received from Miss Emily Slocombe of 555 Townsend Avenue, New Haven, with a statement that these hornets had killed two dahlia plants and injured several more by eating off the bark. On September 25, Messrs. Walden and Garman visited the premises. They saw five or six large plants which had been badly chewed by the hornets as shown on Plate XIV, b. Seven of these large hornets were around one plant and seemed to return to it even after having been driven away. The sap oozed out of the injured plants, fermented, and many adults of the bumble flower beetle *Euphoria inda* Linn., were feeding upon the sour sap. It was suggested to the owner that the stems of the injured plants be sprayed with lead arsenate.

This insect has long been known to gnaw the bark from hard wood twigs often girdling them, but this is the first instance coming under our observation in which it has attacked herbaceous stems. A note regarding the giant hornet and its habit of girdling twigs may be found in the Report of this Station for 1916, page 144.

On October 9, specimens of the European giant hornet were received from Mr. E. Vanderwerken, of Stamford, who writes that Italians and Japanese both regard the species as a great menace to bee keeping, as the adults kill honey bees in great numbers. We have made no observations to confirm this statement.

This hornet is a native of Europe, and was first noticed around New York City some twenty-five years ago, from where it has spread gradually into Connecticut and throughout New Jersey.

It was first collected in Connecticut at New Haven, June 13, 1900, and specimens have been received at the office many times in recent years from Greenwich, Stamford, Darien, Plantsville, Hamden and New Haven. It is shown on Plate XIV, a.

Leaf-Roller on Tartarian Honeysuckle:—In the Report of this Station for 1918, page 342, mention is made of a larva feeding on Tartarian honeysuckle, from which was reared on July 18, a moth belonging to the genus *Harpipteryx* and apparently undescribed. The larvae were rather abundant in the writer's garden in 1920 webbing together and feeding upon the tender terminal leaves. Several adult moths were reared, emerging on July 1. A brief description follows:—

Larva.—15-18 mm. in length; 1.5 mm. thick at fifth abdominal segment, from which it tapers towards both extremities, the taper being greater though less abrupt toward the head: lateral and ventral surfaces leaf-green with a lighter blue-green stripe adjoining dark median stripe, and short diagonal lighter stripes above the spiracles: two longitudinal dorsal stripes, purplish to chocolate brown, separated only by a faint narrow line of lighter color. Head grayish-green, faintly marked and mottled with light-brown, bearing brown hairs. Legs and prolegs green like dorsal surface; anal prolegs prominent. Each segment bears a number of short brown hairs or bristles. Wriggles like a Pyralid, and spins down on a silk thread.

Cocoon.—About 18 mm. in length; 3 mm. thick for two-thirds its length; tapering equally at both ends to a sharp point. Whitish or straw-color. Fastened to a leaf.

Adult.—Wing-spread 20-22 mm. Fore wings chestnut-brown with a conspicuous cream-colored rear margin: near the outer end of this marginal band there extends forward and outward a pointed streak of the same color ending just beyond the disk. Fore wings extended at tips and curved backward forming recurved hooks. A cream-colored dorsal patch on thorax extends over head and palpi: antennae filiform, whitish but annulated with brown or black. Rear wings blackish or smoky-brown with lighter fringe. Abdomen, legs and under surface colored about like rear wings.

Since rearing this moth in 1918, Doctor William Barnes has published* an illustration of an European species *Harpipteryx xylostella* Linn., which appears to be the same as our specimens. Some of our material was therefore sent to Doctor Barnes, who reports it to be the European species *H. xylostella.*

Illustrations of the larva, cocoon and adult may be found on Plate XV.

ILLUSTRATIONS.

All plates are from photographs from the following sources:—Plates IV, V, and X by W. E. Britton; Plate IX, b, and d, by M. P. Zappe; Plate IX, c, by K. F. Chamberlain; Plate XIII, b, by Philip Garman; all others by B. H. Walden. The text figures are from drawings as follows:—Figure 4, map drawn by A. E. Moss; Figure 5, plan of orchard experiments, drawn by E. M. Stoddard; Figure 6, by Philip Garman; Figures 8, 9, 10 and 11, after Dr. E. P. Felt, Cornell Extension Bulletin 27; Figure 11, after J. B. Smith, New Jersey Agricultural Experiment Station; Figures 12, 13, 14, 15 and 16, after C. L. Marlatt, Bureau of Entomology, U. S. Department of Agriculture.

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*Contributions to the Natural History of the Lepidoptera of North America, Vol. IV, page 246, Plate XXVIII, figure 12, 1920.

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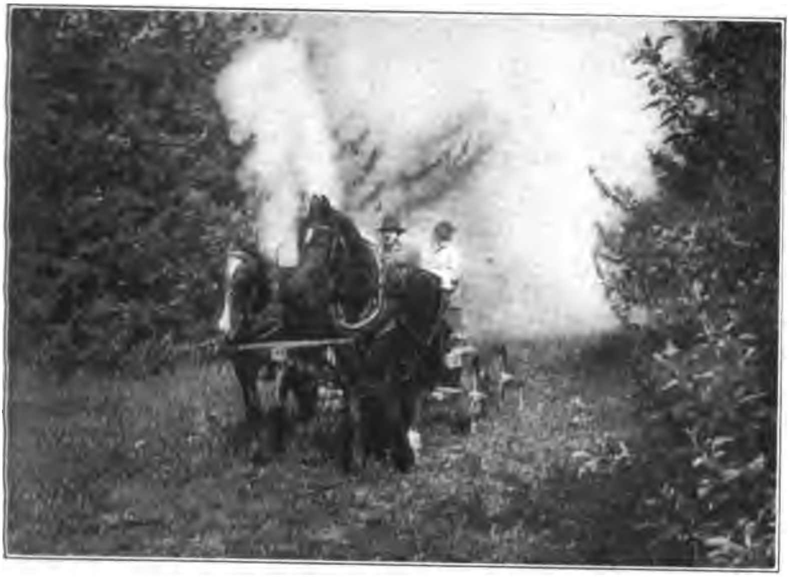
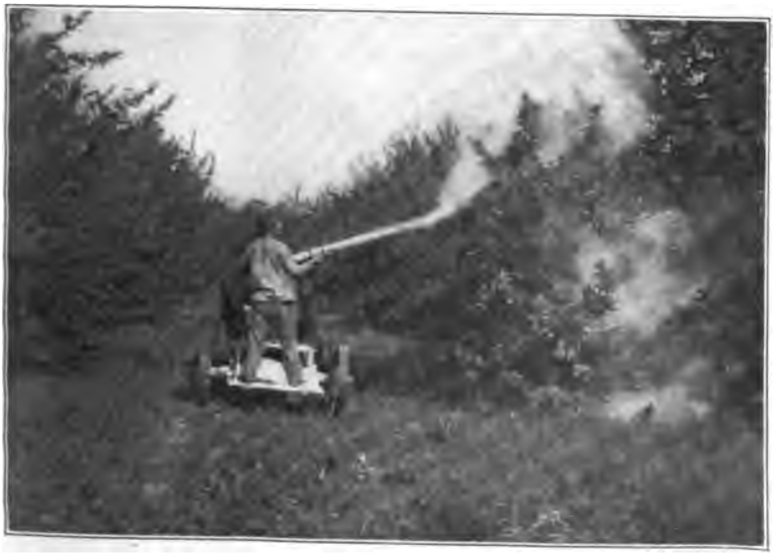


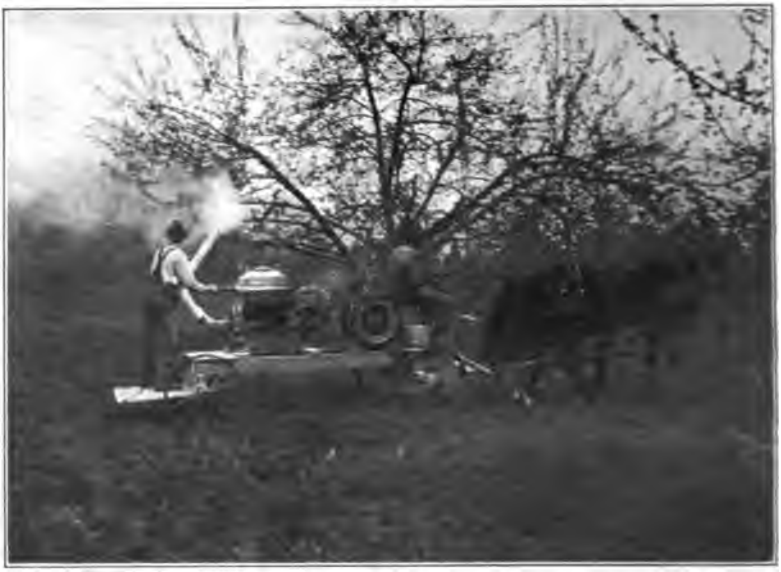
a. Front view of outfit.



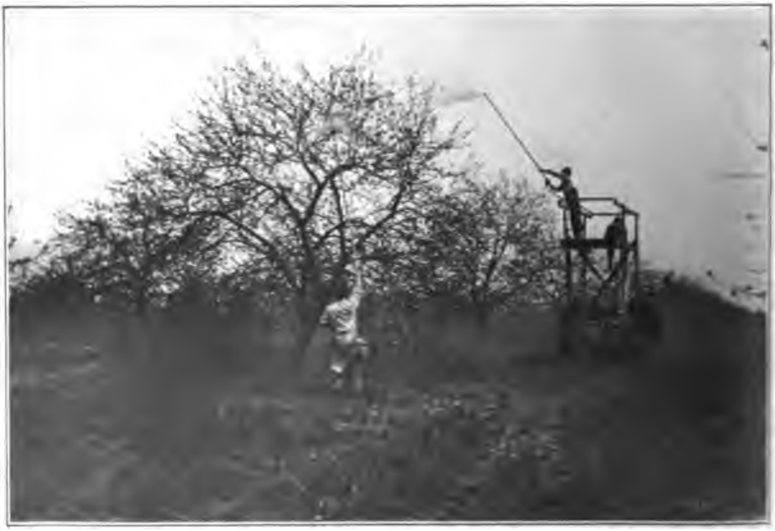
b. Rear view.

DUSTING IN APPLE ORCHARD.

PLATE V.

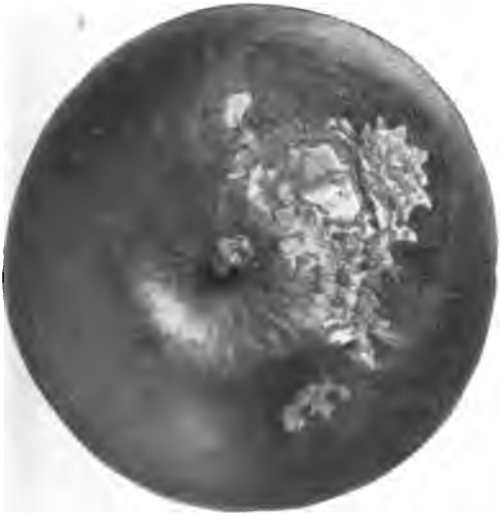


a. Side view of dusting outfit.



b. Spraying outfit used in Platt's orchard.

DUSTING AND SPRAYING IN APPLE ORCHARD.

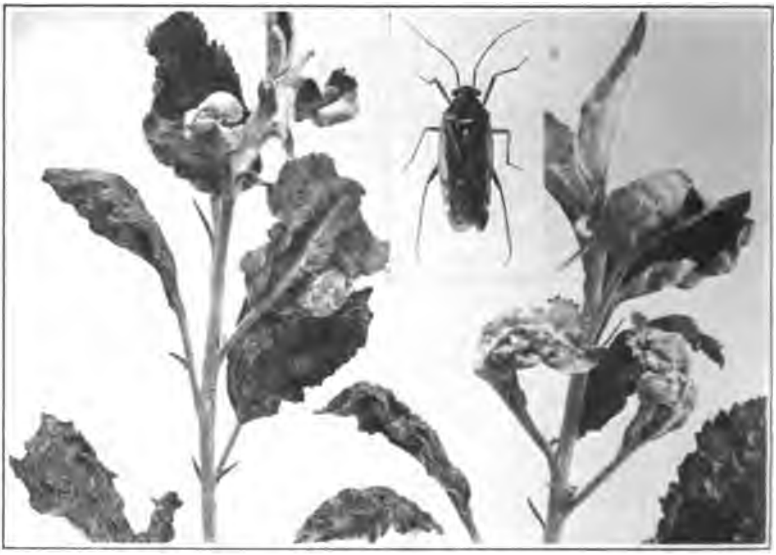


a. Work of red banded leaf-roller on fruit, natural size.

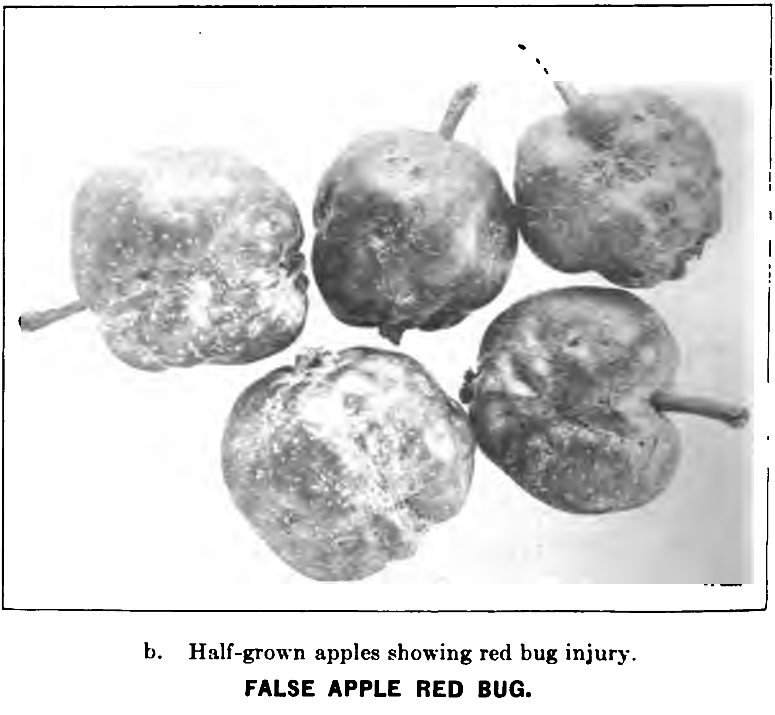
b. Spraying potatoes to kill aphids, at Woodmont.

INJURY TO APPLES: SPRAYING POTATOES.

PLATE VII.

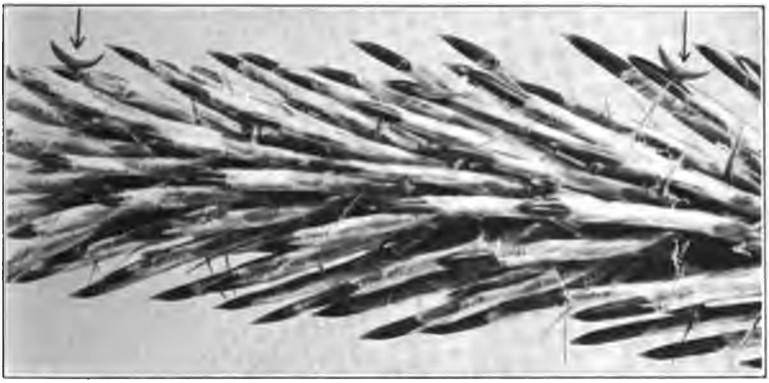


a. Apple trees injured by the false red bug.
Leaves natural size, bug nearly three times enlarged.

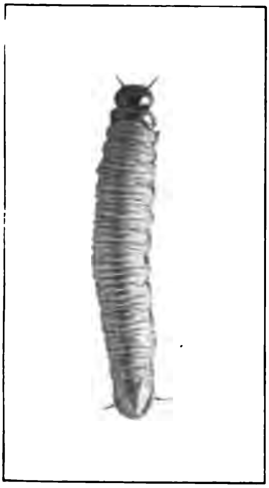


b. Half-grown apples showing red bug injury.

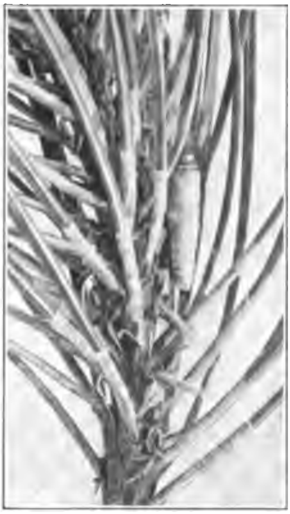
FALSE APPLE RED BUG.



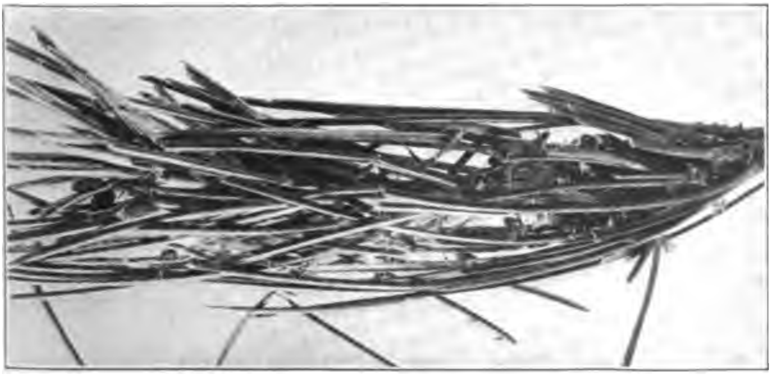
a. Crescent-shaped eggs on developing needles, twice natural size.



b. Larva, twice natural size.



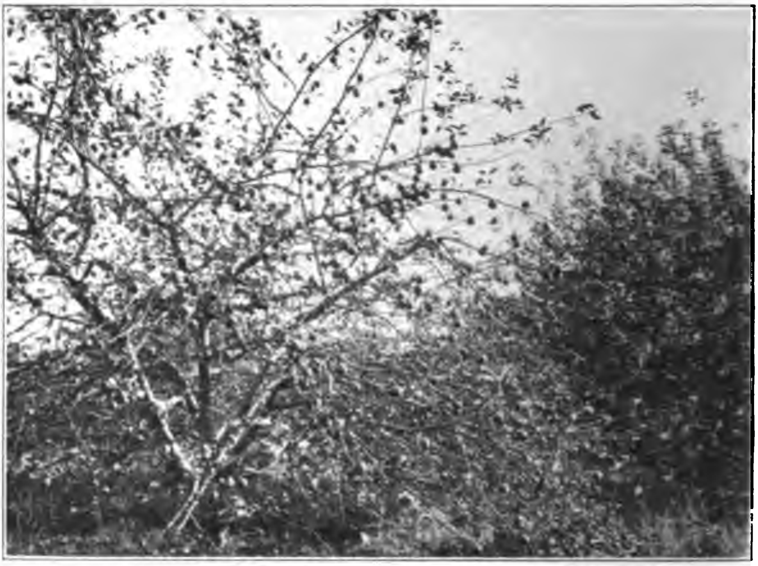
c. Larva feeding in cluster of needles, natural size.



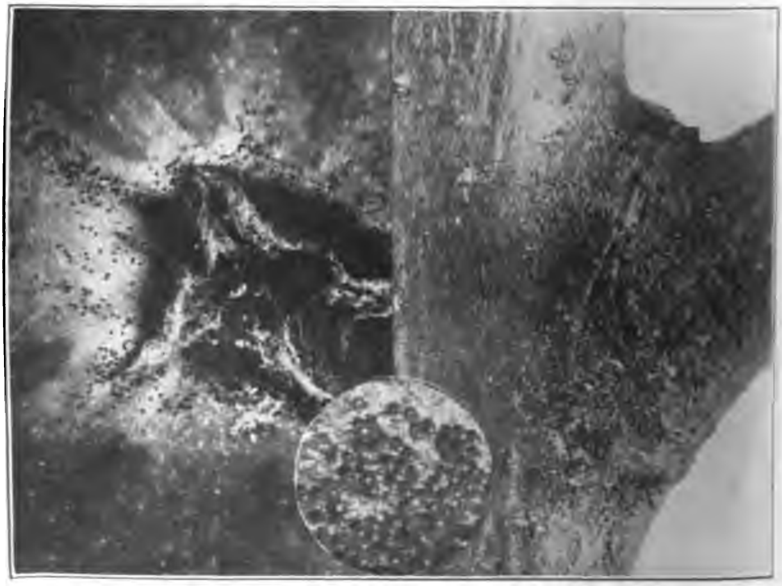
d. Cluster of needles webbed together in characteristic fashion by the larva, natural size.

SAWFLY ON AUSTRIAN PINE.

PLATE IX.

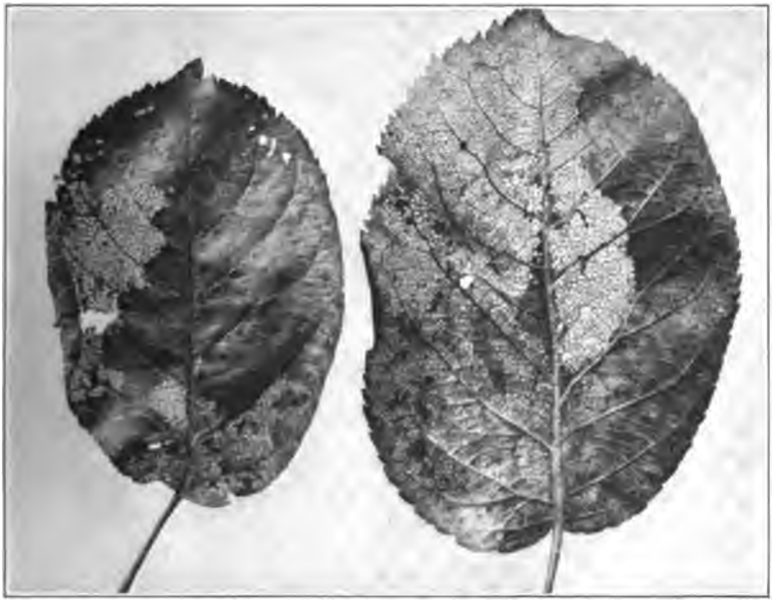


a. Infested apple tree which has lost much foliage from the attacks of the mite.

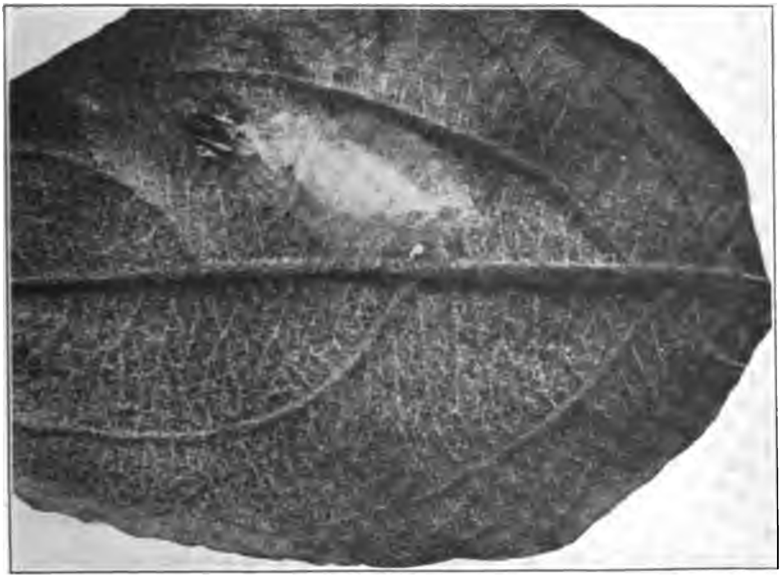


b. Eggs on calyx end of apple, and on twig, three times enlarged: insert, same from twig, enlarged about ten times.

EUROPEAN RED MITE.



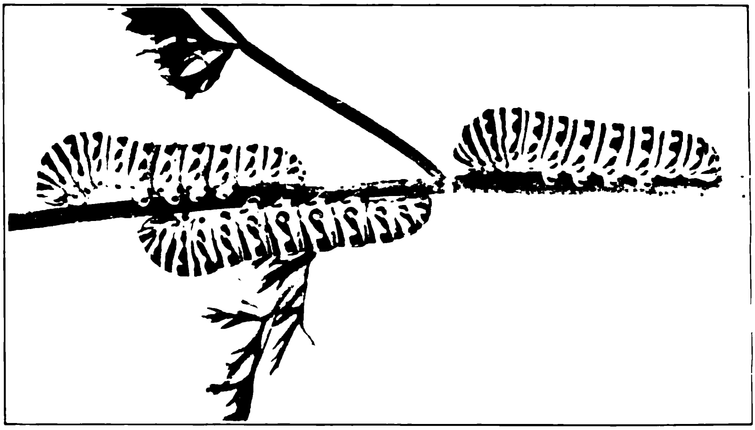
a. Characteristic injury of larvae on apple leaves, somewhat reduced.



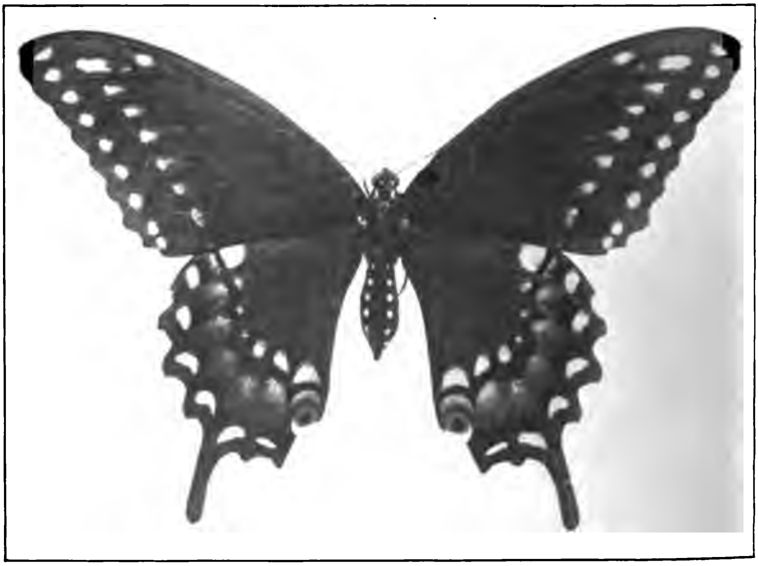
b. Cocoon on under surface of apple leaf, twice natural size.

APPLE AND THORN SKELETONIZER.

PLATE XI.

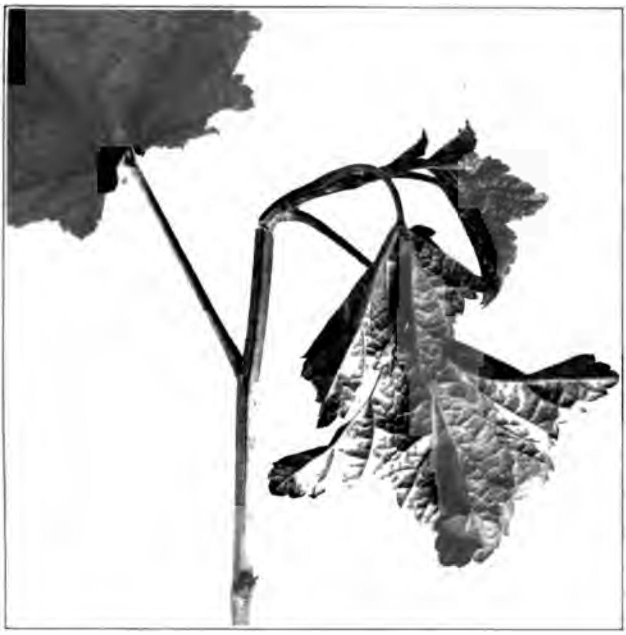


a. Larvae feeding upon carrot, natural size.

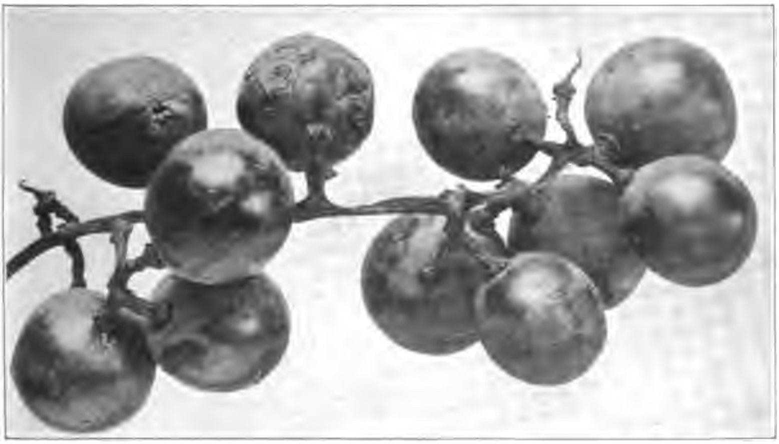


b. Adult, known as the black swallow-tail butterfly; female, natural size.

CELERY CATERPILLAR.



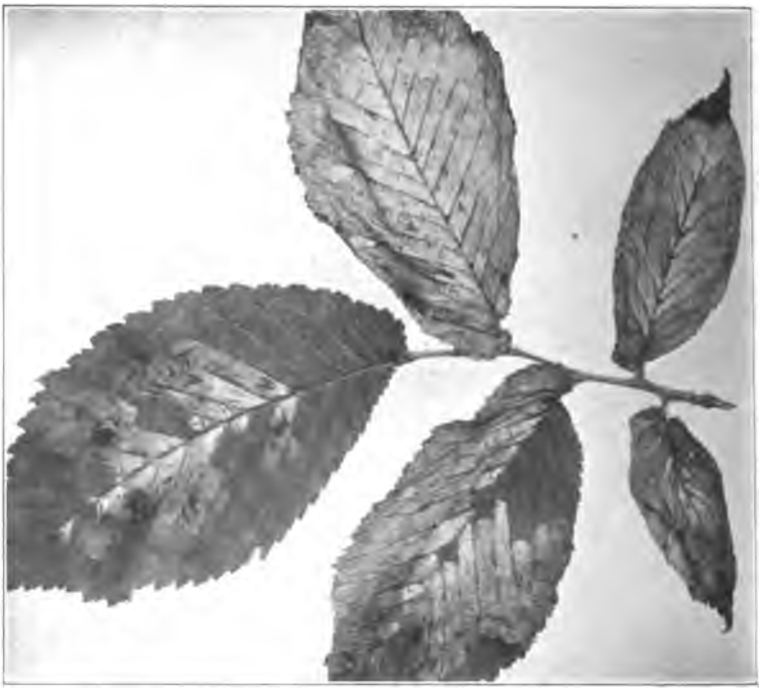
a. Work of currant stem girdler, in severing tip of new shoot. Egg is laid just below the cut. Natural size.



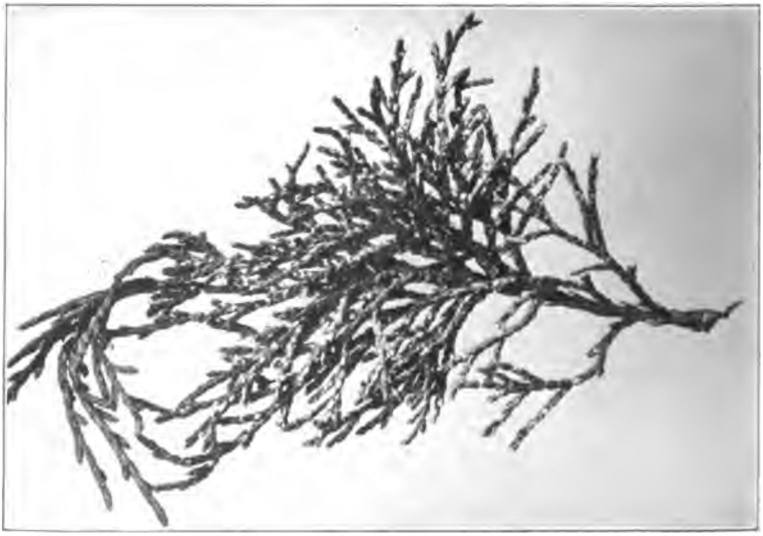
b. Cluster of grapes infested by larvae of the grape berry moth. Natural size.

CURRANT STEM GIRDLER AND GRAPE BERRY MOTH.

PLATE XIII.



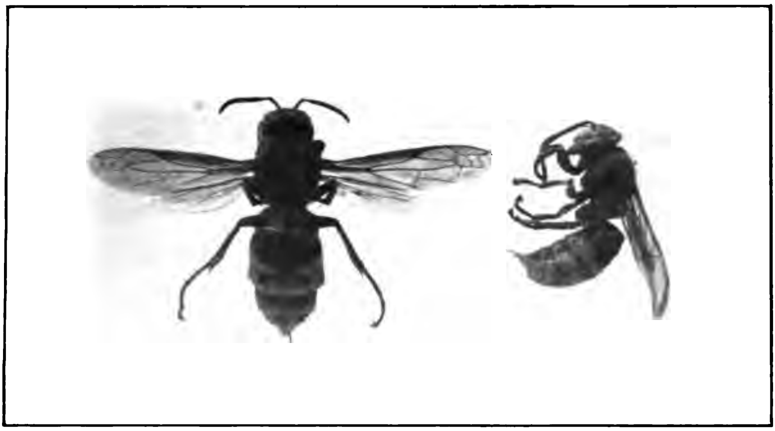
a. Characteristic injury of elm leaf-miner, somewhat reduced.



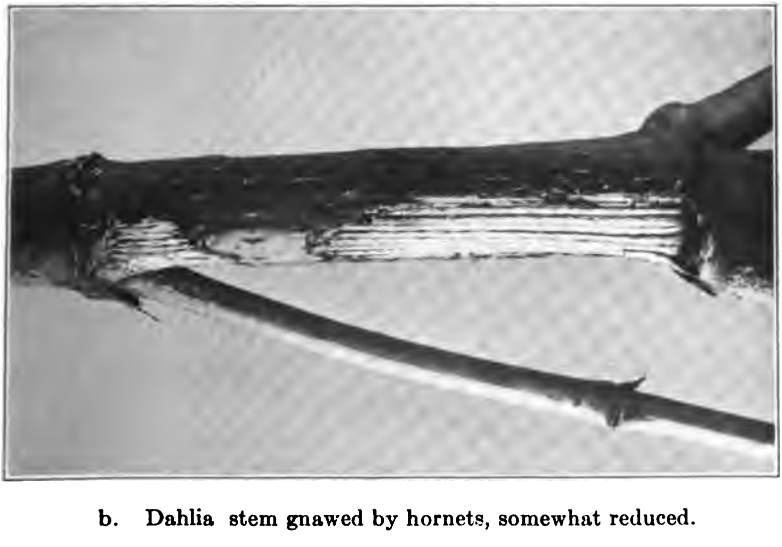
b. Juniper twig, showing scales on leaves, natural size.

ELM LEAF-MINER AND JUNIPER SCALE.

PLATE XIV.



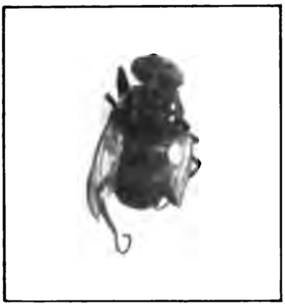
a. Adult hornets, dorsal and lateral views, natural size.



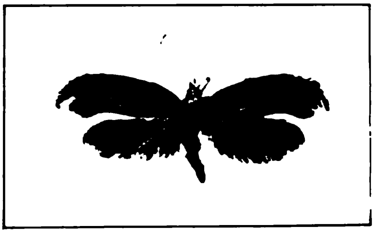
b. Dahlia stem gnawed by hornets, somewhat reduced.

EUROPEAN GIANT HORNET.

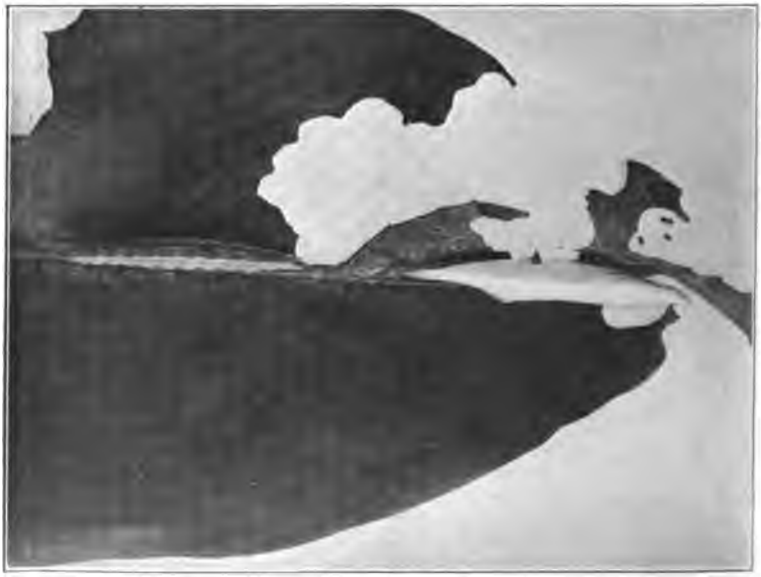
PLATE XV.



a. Adult ox warble or bot fly, twice natural size.



b. *Harpipteryx xylostella*, twice natural size.



c. Larva and cocoon of *Harpipteryx xylostella*, twice natural size.

OX WARBLE OR BOT FLY, AND HARPIPTERYX ON TARTARIAN HONEYSUCKLE.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 227 FEBRUARY, 1921

BEING THE

Twenty-Fifth Report

ON

Food Products

AND

Thirteenth Report on Drug Products.

By E. M. BAILEY.

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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February, 1921.

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Press of The Wilson H. Lee Company.

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The Twenty-fifth Report on Food Products and the Thirteenth Report on Drug Products, 1920.

BY E. M. BAILEY.

The inspection and analysis of foods, drugs and miscellaneous materials made by this station during the past year are presented in this report which marks the twenty-fifth year of food inspection and the thirteenth of drug inspection in this State. The study of methods for the determination of caffein, principally in tea, has been continued and a new proceedure devised for the rapid and accurate estimation of this constituent. An examination of laundry and toilet soaps has been made, and a number of new and interesting diabetic foods have been analyzed. A larger number than usual of alcoholic liquors have been tested, chiefly for wood alcohol, on account of the panic created by the sale of a quantity of "poison whiskey" the alcohol of which was found to be entirely methyl (wood) alcohol.

As for several years past the volume of work done for the Dairy and Food Commissioner has been relatively large. Milk, ice cream, carbonated beverages and drug preparations are the items of chief importance.

An exhibit showing different phases of the laboratory work was prepared as a part of the Station exhibit at the Farmers' Week Fair in Hartford; and a number of papers have been written for presentation at meetings of various associations.

Co-operation with the Association of Official Agricultural Chemists in the study of methods of analysis, with the American Medical Association on matters pretaining to diabetic foods and with the Society of Cotton Oil Chemists in the examination of check cottonseed meals and fertilizers has been continued.

Credit for the analytical work involved is due entirely to Messrs. Andrew, Shepard, Edmond, Nolan and Merwin. Mr. Andrew has shared with the writer much of the court work called for by the Dairy and Food Commissioner.

I. FOODS.

CARBONATED SOFT DRINKS, ETC.

One hundred and eighty-nine samples of soft drinks, cereal beverages, etc., have been submitted by the Dairy and Food Commissioner. They are grouped according to the examinations made of them as follows:

Examined for saccharin 131; saccharin detected in 53.
Examined for capsicum 44; capsicum detected or indicated in 43.
Examined for alcohol 14; alcohol found in excess of 0.5 per cent. in 10.

The presence of saccharin in any normal food constitutes adulteration in this State. Section 2438 of Chapter 128 of the General Statutes declares an article of food to be adulterated "if any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength." Also "if it contains any added poisonous or other added deleterious ingredient which may render such article injurious to health."

While beverages of the soda water type are not drunk primarily for their food value, they possess a food value by virtue of the sugars they contain. Saccharin has no food value but its sweetening power is about 500 times greater than that of ordinary sugar. The addition of saccharin necessarily reduces the food value of any article of food in which it is used as a substitute for sugar; and it is, moreover, a substance which may render food injurious to health.[1] In spite of the growing sentiment against this illegal sweetener among the better class of bottlers it is still used to a considerable extent in the State chiefly, if not entirely, by local establishments.

Saccharin was found in the following samples:

D. C. No.	Brand.		Manufacturer or Dealer.
15119	Strawberry Soda.	*Ansonia:*	Crystal Bottling Works.
17208	Lemon Soda.		G. Soventino.
17223	Cream Soda.	*Bridgeport:*	American Bottling Co.
17219	Cream Soda		Central New York Bottling Co.
17216	Cream Soda.		Gottlieb Luippold.
17221	Strawberry Soda.		Greater New York Bottling Co.
15123	Orange Soda.		Grey & Lights.
17231	Cream Soda.		Hallett Mineral Water Co.
17218	Cream Soda.		Standard Bottlings Works.
15122	Raspberry Soda.		West End Bottling Works.
17235	Raspberry Soda.		West End Bottling Works.
16188	Strawberry Soda.	*Bristol:*	Elco Beverage Co.
15385	Orange Soda.	*Danielson:*	H. B. Hargraves.

---

[1] Food Inspection Decision 142, U. S. D. A.

D. C. No.	Brand.		Manufacturer or Dealer.
16161	Strawberry Soda.	*Hartford:*	United Bottling Works.
16159	Strawberry Soda.		Anthony P. Zazzaro.
16160	Lemon Soda.		Anthony P. Zazzaro.
17779	Ginger Ale Soda.	*Jewett City:*	James Glorvacki.
17778	Strawberry Soda.		James Glorvacki.
17777	Ginger Ale Soda.		Peter Romanek.
17776	Strawberry Soda.		Peter Romanek.
17227	Cream Soda.	*Meriden:*	T. F. Lyons.
17205	Lemon Soda.	*Naugatuck:*	John Greene.
15596	Cream Soda.	*New Britain:*	S. F. Avery.
15593	Strawberry.		Eureka Bottling Co.
16152	Lemon Soda.	*New Haven:*	Atlantic Bottling Works.
16956	Ginger Ale Soda.		Clancy Bottling Works.
16952	Sarsparilla Soda.		Golden Eagle Bottling Works
16960	Ginger Ale Soda.		Hamilton Bottling Works.
16964	Lemon Soda.		Virginia Linauro Bottling Works.
16963	Soda.		Frank Mosca Bottling Works
16961	Lemon Soda.		New Haven Bottling Works.
15121	Lemon Soda.		Harry Owen.
16954	Cream Soda.		Shanbron Bottling-Works.
17312	Ginger Ale Soda.		Smile Bottling Works.
17313	Cream Soda.		Smile Bottling Works.
16955	Orange Soda.		Yale Bottling Works.
18435	Ginger Ale Soda.	*Norwalk:*	Morris Slopshin.
18436	Strawberry Soda.		Morris Slopshin.
17244	Cream Soda.	*Norwich:*	D. A. Sullivan.
18438	Strawberry Soda.	*South Norwalk:*	Adolf Dreifuss.
17211	Lemon Soda.	*Stamford:*	Silver Springs Water Co.
17214	Strawberry Soda.		National Spring Water Co.
17329	Strawberry Soda.	*Stratford:*	George Bovodach & Steve Tomasco.
17330	Cherry Soda.		George Bovodach & Steve Tomasco.
18246	Strawberry Soda.	*Taftville:*	Albert LaBarre.
16191	Cream Soda.	*Thomaston:*	August Koegel.
15588	Strawberry Soda.	*Waterbury:*	Brass City Bottling Works.
15590	Strawberry Soda.		Brooklyn Bottling Works.
16200	Strawberry Soda.		J. A. Silver.
15390	Strawberry Soda.	*Willimantic:*	John Latusek.
16985	Lemon Soda.		John Latusek.
17201	Lemon Soda.		Mosca & Salvatore.
17203	Strawberry Soda.		Mosca & Salvatore.

Beginning January 1st, 1921, the presence of capsicum in ginger ale must be stated upon the label[1].

By official definition "ginger ale is the carbonated or artificially carbonated beverage prepared with potable water, acidulated sugar (sucrose) syrup, and ginger ale flavor," ginger ale flavor being the water-soluble product obtained from ginger, with or without flavoring substances which do not simulate the flavor or pungent effect of ginger.

"Ginger ale with capsicum is the carbonated or artificially carbonated beverage prepared with potable water, acidulated sugar (sucrose) syrup, and ginger ale with capsicum flavor," ginger ale with capsicum flavor being the water-soluble product obtained from ginger and capsicum, with or without other flavoring substances.

---

[1] F. I. D. No. 177.

The predominating flavor in both ginger ale and ginger ale with capsicum is that of ginger.

The beverage called ginger ale is said to have originated in England and the presence of capsicum in the formula appears to have been established by general use, its purpose being to add pungency to the product. Why the beverage should have been called ale is not apparent. It bears no resemblance to the product of that name prepared from malt and hops and is not fermented.

The method we have used for the detection of capsicum indicates the presence of capsicum or other pungent substances foreign to ginger[1]. By this method capsicum was indicated in the following samples:

D. C. No.	Brand.		Manufacturer or Dealer.
17222	Ginger Ale	*Bridgeport:*	American Bottling Works.
17215	Ginger Ale		Gottlieb Luippold.
17220	Ginger Ale.		Greater New York Bottling Co.
17232	First Prise		Grey & Light.
17230	Ginger Ale.		Hallett Mineral Water Co.
17217	Ginger Ale.		Standard Bottling Co.
17234	Ginger Ale.		West End Bottling Co.
17237	Ginger Ale.		Whistle Bottling Co.
16180	Ginger Ale.	*Bristol:*	Bristol Bottling Works.
16189	Ginger Ale		The Elco Beverage Co.
16186	Cascade		C. E. Perkins Bottling Works.
17252	Ginger Ale	*Central Village:*	U. LaFrance.
17250	Ginger Ale.	*Danielson:*	H. B. Hargraves.
16172	Ginger Ale.	*Hartford:*	Hartford Bottling Works.
17224	Hydrox.	*Meriden*	Charles N. Carroll.
17226	Sun Ray.		T. F. Lyons Co.
17204	Ginger Ale.	*Naugatuck:*	John Greene.
15597	Ginger Ale.	*New Britain:*	S. F. Avery.
15594	Ginger Ale.		Eureka Bottling Works.
15595	Ginger Ale.		William Naughton.
17242	Pequot Brand.	*New London:*	Bagdanowsky Bros.
16199	Ginger Ale.		Rich & Rubin.
17238	Ginger Ale.		Steam Bottling Works.
17247	Ginger Ale.		Chester Wright.
17243	Ginger Ale	*Norwich:*	Crystal Spring Co.
16183	Ginger Ale	*Portland:*	Portland Bottling Works.
17249	Ginger Ale.	*Putnam:*	Putnam Bottling Works.
17115	Ginger Ale.	*South Manchester:*	Manchester Bottling Works.
17213	Ginger Ale.	*Stamford:*	National Spring Water Co.
17210	Ginger Ale.		Silver Spring Water Co.
16190	Ginger Ale.	*Thomaston:*	August Koegel.
17228	Ginger Ale.	*Wallingford:*	R. S. Botsford.
16181	Ginger Ale.	*Middletown:*	Duchess Bottling Works.
15599	Arauna.		M. T. Fitzgibbons.
15587	Ginger Ale.	*Waterbury:*	Brass City Bottling Works.
15589	Ginger Ale.		Brooklyn Bottling Works.
16192	Ginger Ale.		Eagle Brewing Co.
16193	Ginger Ale.		Hamilton Bottling Works.

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[1] A. O. A. C. Methods of Analysis, p. 206. 1919.

D. C. No.	Brand.		Manufacturer or Dealer.
16197	Ginger Ale.	*Waterbury:*	Mascola Bottling Works.
17209	Elco Ginger Paste.		Emil Moscola.
16198	Ginger Ale.		Reiner Bottling Works.
16196	Ginger Ale.		Yale Brewing Co.
16986	Ginger Ale.	*Willimantic:*	Willimantic Bottling Co.

Eight miscellaneous beverages, sodas, cordials, etc., were submitted for determinations of alcohol. All were found to contain alcohol in excess of 0.5 per cent., but as only one sample was submitted in the original unopened bottle the alcohol content as sold by the dealer cannot be stated. The one unopened sample was Cider soda, **16185**, which contained 1.19 per cent. of alcohol by volume. It was sold by the Bristol Bottling Works, Bristol.

Six cereal beverages were submitted, all in original unopened bottles. Palpha **17206**, Brooklyn Bottling Works, Waterbury, and Fingo **15383**, Worcester Brewing Corp., Worcester, Mass., contained 0.61 and 0.84 per cent. alcohol by volume respectively.

Beverages and Fruit Syrups Examined for Saponins.

The presence of foam producers in various soft drinks and in malt liquors has been reported or suggested in the literature. Preparations from soap bark and commercial saponin are used for this purpose but they are objectionable on account of the toxic principles they contain. Glycerrizin, the active principle of licorice, also serves to produce the desired foam.

Tests for saponins are summarized in Leach[1] and we have found them to work satisfactorily upon known saponin solutions. An old commercial preparation labeled "Soda Foam," which we had among our laboratory specimens and a water extract of soap bark responded positively to the tests there described. If glycerrizin is present or suspected the haemolysis test should be used. While it is generally best to extract the saponins and purify them before applying qualitative tests, suspicious samples may be sorted out by inducing foam directly in the solution by passing a current of air through it, collecting the froth and applying tests directly on the liquid formed when the foam subsides.

Six fruit syrups and three cereal beverages were examined for foam producers but negative results were obtained in all cases.

CEREAL PRODUCTS.

Breakfast Foods.

Two fruited cereal preparations have been analyzed. Fruited Wheat, **13973** and Fruited Oats, **13974**, a combination of figs, dates and raisins with wheat and oats respectively. Manufactured for the Fruited Cereal Co., Quincy, Ill.

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[1] Food Inspection and Analysis, p. 1016.

Analyses of these products are as follows:

Station No.	13973	13974
	%	%
Moisture	9.89	9.74
Ash	3.60	3.34
Protein	15.63	13.13
Fiber	2.42	1.30
Nitrogen-free extract	66.21	68.10
Fat	2.25	4.39

HEALTH FOODS.

Three products of this class have been examined.

Ry-Krisp, **14200**, made by the Original Ry-Krisp Co., Minneapolis, Minn. This preparation is stated in the advertising literature to be made from whole rye "without soda, baking powder, yeast, or any ferment, without sweetening, shortning, or flavoring except a little salt." It is also stated to contain "nine out of the eleven mineral elements (vitamines) necessary for the proper nourishment of the human body". So far as we know it has not been demonstrated that vitamines are mineral elements. A proximate analysis of the preparation is given which is substantially correct. It is not recommended as a diabetic food but its laxative properties are emphasized.

The product was submitted for examination with reference to its usefulness in a diabetic dietary. The analysis shows a normal amount of carbohydrate nearly one-half of which is starch. Its utility in a diabetic diet will depend entirely upon the tolerance of the patient.

Swedish Health Bread, **13628**, made by O. G. Petterson, Cambridge, Mass. Submitted for analysis by a diabetic patient.

Basy Bread, **14405**, made by Doctor's Essential Food Co., Orange, N. J. This is used as an anti obesity remedy. It is stated not to be a medicine or drug but a wholesome and delicious food scientifically prepared. Three slices per day are said to accomplish weight reduction.

The proximate analysis of this preparation is given below. It furnishes no clue of course to the alleged efficacy of the bread as a weight reducer. Having been advised that symptoms resembling those which follow the administration of thyroid had been observed after eating this bread, tests were made for iodine but none was detected. The method of Seidell[1] was employed and amounts up to 20 grams of bread were used. A commercial sample of desiccated thyroid gland[2] was tested by the same procedure and 0.2 per cent. of iodine found. When 10 milligrams of this thyroid preparation were added to 0.99 gm. of bread a positive test for iodine was obtained.

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[1] Jour. Biol. Chem., **3**, 391 (1917).

[2] Parke, Davis & Co.

We have since seen a discussion[1] of this product from which we quote.

> "According to the manufacturers Basy Bread is made from coarse ground, hard whole wheat, preserved and sweetened with ground figs and containing vinegar, salt and water".

After giving analyses showing the composition of this bread as compared with average graham bread the discussion continues.

> "The purchaser of Basy Bread finds that, in addition to eating the preparation for which he is paying $1.00 a loaf, it is also necessary to follow the 'Basy Bread' Diet. This diet is typical of those recommended in the reduction of fat".

By a simple experiment the user of this bread can test its efficacy for himself by adhering rigidly to the prescribed diet omitting the Basy Bread entirely and comparing the results with those obtained when it is included. We suspect that the diet has more to do with weight reduction than has the bread.

The analyses of these three preparations are as follows:

Station No.	**14200**	**13628**	**14405**
	%	%	%
Moisture	5.80	8.55	36.91
Ash	2.78	2.71	2.40
Protein	14.00	10.44	9.59
Fiber	1.34	1.82	1.85
Nitrogen-free extract:			
Starch	34.79	47.73	48.12
Other nitrogen-free extract	39.63	27.68	
Fat	1.66	1.07	1.13

FLOUR.

Four samples of flour were submitted by the Dairy and Food Commissioner and four samples were sent by individuals. Of the latter, Nos. **15167** and **15173** were represented to be largely gluten. Analyses showed them to contain 2.08 per cent. of nitrogen each which is about the nitrogen content of ordinary flour and much too low for gluten flour of standard quality which should contain not less than 7.1 per cent. of nitrogen on a water free basis or about 6.25 per cent. with the amount of moisture generally present in the market product.

The other samples require no comment.

CIDER.

Six samples were examined. Two, Nos. **18405** and **18424**, were sent by the Dairy and Food Commissioner and four, Nos. **15284**, **14172**, **14338** and **14339** were submitted by individuals. They were examined chiefly for alcoholic content, but a more complete analysis of **18405** was made as follows:

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[1] Jour. Am. Med. Assoc., **70** 6, 407 (1918).

Alcohol by volume	2.87%
Solids	5.92
Ash	0.27
Sugar, as invert	4.01
Acidity, as acetic	0.48
Alkalinity of ash cc. N/10 alkali per 100 gms.	32.1

COCOA.

Four samples have been examined.

Liberty Milk Cocoa, **18408,** labeled pure milk cocoa, submitted by the Dairy and Food Commissioner was analyzed as follows:

Moisture		2.00%
Ash		2.06
Alkalinity of ash, cc. N/10 acid/1 gm.	0.75	
Nitrogen:		
Total	1.60	
From casein	0.42	
Protein:		
Casein		2.68
Other protein		7.38
Fiber		1.48
Nitrogen-free extract:		
Sucrose		65.09
Lactose		4.83
Other N-free extract		4.48
Fat		10.00

The sample appears to be as labeled.

Three samples of unsweetened cocoa submitted by a consumer were of normal composition and quality.

COFFEE, MODIFIED COFFEE, ETC.

Fourteen samples of ground coffee, two of soluble coffee, one of Kaffee Hag and one coffee substitute have been examined.

Two of these were submitted by the Dairy and Food Commissioner. **16393** contained chicory and much starchy matter and was labeled coffee, cereal and chicory. **16721** appeared to be genuine and was passed.

Sample **15158** sent by a purchaser to be tested for adulterants also appeared to be genuine.

Kaffee Hag, **13980,** is coffee from which the caffein has been largely removed. It was found to contain 0.12 per cent. caffein by weight and 0.10 per cent. of caffein calculated from nitrogen in the caffein residue. Previous results[1] were 0.04 and 0.03 per cent. respectively.

Minute Brew, **13981,** a substitute for coffee made from cereal grains contained 11.25 per cent. of protein (N x 6.25), 1.55 per cent. of material insoluble in hot water and was free from caffein.

Partial analyses of eleven samples of ground coffee and two of soluble coffee are given in Table I.

Table I. Partial Analyses of Coffee.

Sta. No.	Brand.	Manufacturer.	Water. %	Ash. %	Fat. %	Caffein, by Wt. %	Caffein, from N. %	Evidence of Chicory, Cereals, etc.
		Soluble Coffee.						
13938	Barrington Hall	Baker Importing Co., New York and Minneapolis.	4.12	15.51	1.32	5.66	5.50	......
13202	Faust Instant	C. F. Blanke Tea and Coffee, Co., St. Louis.	5.37	14.88	1.11	4.47	4.36	......
		Ground Coffee.						
13203	Autocrat	Brownell Field Co., Providence, R. I.	5.56	4.05	15.48	.....	.....	none
13183	Benefit	Direct Importing Co., Boston.	7.28	4.03	15.24	.....	.....	none
13966	Boardman's Gold Star	Wm. Boardman Sons Co., Hartford.	6.05	4.23	15.09	.....	.....	none
13940	Boardman's Putnam	Wm. Boardman Sons Co., Hartford.	3.97	4.09	16.21	.....	.....	none
13953	Garden of Allah	Clark & MacKasick Co., Boston.	6.43	4.12	16.40	.....	.....	none
13964	Golden Star	F. C. Bushnell Co., New Haven.	4.57	4.05	14.83	.....	.....	none
13174	Hermitage	Stoddard, Gilbert & Co., Inc., New Haven.	7.09	4.02	15.34	.....	.....	none
13952	Hodbro	Hodes Bros., New Haven.	4.79	4.11	15.44	.....	.....	none
13965	Sunbeam	Austin, Nichols & Co., New York and Chicago.	2.14	4.24	14.63	.....	.....	none
13941	Union Club	Chas. G. Lincoln & Co., Hartford.	4.69	4.08	15.66	.....	.....	none
13939	White House	Dwinell-Wright Co., Boston and Chicago.	4.49	4.16	15.86	.....	.....	none

The soluble coffees are evaporated and pulverized water extracts of coffee. Another preparation of this type, viz., G. Washington Prepared Coffee has been analyzed previously[1] in this laboratory.

DESICCATED FOODS.

A number of evaporated or dried food products made by the Keystone Instant Food Co., Inc., Danbury, Conn., have been analyzed. The products include Clam Broth, **15460**; Vegetable Soup, **15461**; Chicken Gumbo, **15462**; Rice Pudding, **15463**; Roast Beef Hash, **15464**, and Corned Beef Hash, **15465**.

Another product of this type is Cheshire Rabbit, **15184**, **15185**, made by Cheshire Kitchens, Inc., 15 Park Row, N. Y. This is an evaporated prepared Welsh rabbit ready to serve after adding milk or water and heating.

Our analyses of these products are as follows:

TABLE II.—ANALYSES OF DESICCATED FOODS.

No.	15460 %	15461 %	15462 %	15463 %	15464 %	15465 %	15184 %	15185 %
Moisture	8.38	10.58	10.06	6.67	10.81	8.29	9.18	16.88
Ash	34.51	13.67	8.22	3.09	7.15	8.39	7.43	7.88
Protein	36.38	14.06	12.50	12.06	32.25	31.38	30.69*	28.10*
Fiber	.....	3.38	1.26	0.36	0.97	0.80	13.40	15.74
Nitrogen-free Extract	19.00	56.56	66.23	77.74	42.31	41.81		
Fat	1.73	1.75	1.73	0.08	6.51	9.33	39.30	31.40
Salt	29.20	.....	.....	.....	.....	.....	2.84	4.45
Acidity, as lactic acid	.....	.....	.....	.....	.....	.....	1.80	1.87
Color	.....	.....	.....	.....	.....	.....	natural	Orange I

*Nitrogen x 6.38.

DIABETIC FOODS.

A number of diabetic preparations have been examined since our Bulletin 220 on this subject was published. Among them is an interesting product called Cellu Flour.

Cellu Flour, **14555**, is prepared by the Dietetic Cellulose Co., Chicago. It is a carbohydrate substitute made from purified and bleached wood pulp, straw pulp or cotton fiber; it is white, tasteless and non-nutritive, containing no starch, sugar, fat or protein; and is used for filling out reduced diets such as indicated in the Allen Treatment of diabetes. While it furnishes no nourishment it is said to satisfy hunger and reduces the tendency to over-eat. It might be called a psychological food.

The analysis of this flour is as follows:

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[1] Conn. Exp. Sta. Report 1916, pp. 186–7.

Moisture	5.52%
Ash	0.30
Protein	none
Fiber	57.25
Nitrogen-free extract:	
Starch	none
Reducing sugars:	
before hydrolysis	none
after hydrolysis	none
Other nitrogen-free extract (modified cellusoses)	36.93
Ether extract	trace

By the conventional method of proximate analysis this material showed 57.25 per cent. of crude fiber and a nitrogen-free extract of 36.93 per cent. It was found, however, that neither the acid nor alkali digestates as obtained in the determination of crude fiber produced copper reducing substances and that therefor presumably, little of the material thus removed is available in digestion but consists rather of soluble cellulose complexes or modifications. This emphasizes the inaccuracy that, in some cases, may attach to the interpretation of nitrogen-free extract as available carbohydrate in calculating calorie yields.

Our attention was called by William G. Beale, of Chicago, and Bar Harbor, Me., to certain bakery products prepared from Cellu flour by the Woman's Baking Co., of Boston. This Company has submitted, at our request, a number of their products which are of particular interest. Samples were also submitted by Mr. Beale.

The products examined are as follows:

Cellu Muffins, **15256**; Bran Muffins, **15257**; Cellu Caraway Cookies, **15258**; Cellu Lemon Cookies, **15259**; Cellu Kisses, **15260**; Cellu Nuts, **15314**; Cocoa Nib Cookies, **15315**; Spice Bran Cookies, **15316**; Cellu Vanilla Cookies, **15317**; Cellu Soup Wafers, **15318**; Cellu Biscuit **15319**; Caraway Bran Cookies, **15320**.

TABLE III.—ANALYSES OF CELLU FLOUR PRODUCTS, ETC.

Sta. No.	Moisture.	Ash.	Nitrogen.	Protein Nx 6.25.	Fiber.	Nitrogen-free Extract.			Fat.	Calories per 100 gms.
						Starch.	Sugar as dextrose.	Other N-free extract.		
	%	%	%	%	%	%	%	%	%	
15256	29.08	5.37	0.59	3.66	18.23	1.61	2.10	27.02	12.93	254
15257	41.51	6.50	1.00	6.26	6.72	1.54	4.83	27.03	5.61	209
15258	14.16	5.48	0.89	5.58	16.53	1.51	2.33	31.95	22.46	368
15259	12.94	5.22	0.69	4.32	17.43	trace	4.62	34.10	21.37	364
15260	17.85	4.09	3.68	23.00	27.12	1.29	1.20	25.22	0.23	205
15314	15.91	5.71	0.86	5.38	16.80	1.07	2.57	23.82	28.74	390
15315	14.87	6.30	1.33	8.33	6.05	6.19	5.05	29.17	24.04	411
15316	16.31	6.43	1.12	6.99	6.90	4.44	7.77	32.48	18.68	375
15317	17.16	5.69	0.71	4.45	16.98	1.58	2.22	32.61	19.31	337
15318	14.22	6.66	0.64	4.01	14.97	1.69	2.43	31.39	24.63	380
15319	32.81	6.33	0.53	3.34	14.26	1.60	1.41	25.65	14.60	259
15320	12.24	6.90	1.30	8.13	2.62	3.15	3.34	38.61	25.01	438

These Cellu products are conspicuous for their low nitrogen (except **15260**), low available carbohydrate (starch and soluble reducing sugars), high fiber and high nitrogen-free extract other than starch and sugar. The low or doubtful availability of the last named group should be borne in mind when interpreting the calorie yield which has been calculated in the conventional way including all of the nitrogen-free extract. The bran and part-bran products have distinctly less fiber.

Seven samples of liquors were examined with reference to their fitness for use in a diabetic dietary. Four of the samples were practically free from sugars, one contained a small amount, 3.09 per cent., and two showed larger amounts viz. 14.2 per cent. and 33.52 per cent. The last named amount is too high to be used with safety, and a stimulant with 14 per cent. of sugar should be used with caution.

EGGS AND EGG PRODUCTS.

Twenty-six samples of eggs were examined with reference to the composition of the shells. This work was done in collaboration with Prof. Dunn, of the Storrs Station. The figures given are on the basis of the air-dry shells with the inner membranous lining of the shell removed.

TABLE IV.—ANALYSES OF EGG SHELLS.

Sta. No.	Wt. of shell. grams.	Moisture.	Lime (CaO).	Magnesia (MgO).	Loss on ignition.
		%	%	%	%
15223	5.7745	0.55	52.20	1.54	45.42
15224	5.7643	0.39	52.24	....	46.07
15225	5.4725	0.29	52.16	2.48	45.78
15226	5.0275	0.35	52.08	1.04	46.25
15227	6.2050	0.29	52.01	1.20	46.15
15228	5.1178	0.40	51.56	1.35	46.39
15229	4.4340	0.29	51.82	....	46.15
15230	5.8283	0.22	51.91	....	45.70
15231	4.8030	0.21	51.99	1.43	45.92
15232	5.0580	0.23	53.28	....	45.54
15233	5.3550	0.34	53.28	....	45.41
15234	5.5155	0.50	51.85	1.61	45.69
15235	5.0840	0.50	52.69	....	45.77
15236	5.4008	0.63	52.18	....	45.67
15237	5.0183	0.64	52.36	....	45.70
15264	4.8412	....	49.40	....	.....
15265	4.8932	....	52.12	....	.....
15266	5.4114	....	51.04	....	.....
15267	5.2107	....	51.16	....	.....
15268	5.5765	....	51.12	....	.....
15269	5.6312	....	49.16	....	.....
15270	5.3247	....	51.56	....	.....
15271	4.9495	....	50.68	....	.....
15272	5.7060	....	50.88	....	.....
15273	4.9926	....	49.52	....	.....
15274	5.4776	....	50.32	....	.....

EGG POWDER.

One sample, No. **14680**, was submitted for examination. It was labeled Aigo Baking and Cooking Compound, The Egg-O Co., Baltimore, Md., and stated to consist of sprayed egg yolk, albumen, salt, powdered skimmed milk, starch, gelatin, bicarbonate of soda and to be free from coloring matter.

The presence of egg was indicated by a considerable amount of lecithin phosphoric acid and no artificial color was found.

The anaylsis is as follows:

No.	**14680**
	%
Moisture	6.83
Ash	9.47
Protein (N x 6.25)	20.48
Starch	26.40
Fat	13.85
Lecithin P_2O_5	0.46
Color	natural.

EGG NOODLES.

Eight samples of noodles were examined and the partial analyses are given in the following tabulation.

TABLE V.—PARTIAL ANALYSES OF EGG NOODLES.

Sta. No.	Brand.	Manufacturer or Dealer.	Ash.	Protein.	Lecithin P_2O_5.	Color.
			%	%	%	
13204	Mohican.	Mohican Co., Bridgeport	0.88	16.25	0.044	natural
13205	Mueller's.	C. F. Mueller Co., Jersey City	1.15	13.88	0.037	natural
13208	Warner's.	Warner Macaroni Co., Inc., Syracuse, N. Y.	0.68	14.88	0.028	natural
13209	Freihofer's.	Freihofer Baking Co., Philadelphia, Pa	0.51	12.94	0.034	natural
13935	Climax.	The Pfaffmann Egg Noodle Co., Cleveland, Ohio	1.66	13.44	0.045	natural
13937	Egg Soup Pastels.	Freihofer Baking Co., Philadelphia, Pa	0.78	13.19	0.029	natural
13962	Quaker.	Quaker Oats Co., Chicago	0.75	15.00	0.066	natural
13976	Brown Hen.	American Macaroni Co., Camden, N. J.	1.04	16.56	0.043	natural

The lecithin phosphoric acid content is taken as an index to the amount of egg material present. Accepting Juckenack's standard[1], 0.0225 per cent. of lecithin phosphoric acid may be found in noodles prepared without eggs and this amount is more than doubled by the addition of egg or egg yolk in the proportion of one to a pound of flour. Figures less than 0.035 or 0.040 per cent. do not indicate appreciable amounts of eggs.

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[1] Conn. Exp. Sta. Report 1904, p. 138: Leach, Food Inspection and Analysis p. 364.

DEHYDRATED EGGS.

Two samples of dehydrated fresh eggs were examined. These were Atlas Brand, **13173**, Atlas Specialty Co., New York and Community Brand, **13169**, The Sweet Nut Butter Co., Boston.

Analyses are as follows:

No.	**13173**	**13169**
	%	%
Moisture	6.25	6.62
Ash	3.42	3.50
Protein	40.44	43.00
Fat	45.12	42.29
Lecithin P_2O_5	1.37	1.33

These analyses agree with those of similar products previously examined[1] and show the substance of whole egg material.

FATS AND OILS.

OLIVE OIL.

Five samples of olive oil have been examined and all were passed as genuine. Two of these were sent by the Dairy and Food Commissioner and three were submitted by individuals.

COOKING FATS.

Two samples of Snowdrift Pure Vegetable Shortening **13972** and **18404** and one of Peerless Paste **16158** were examined. Snowdrift is a vegetable product consisting of, or containing cottonseed oil. Peerless Paste contains cottonseed oil but not butter fat although other fat of animal origin may be present. It is interesting to note that this sample responds to tests for carrotin although the material is not sensibly colored.

BUTTER.

Twenty-three samples of butter have been examined of which twenty-two were submitted by the Dairy and Food Commissioner. Eighteen were passed and five contained excess of water and were deficient in fat. Butter and renovated butter must not contain less than 82.5 per cent. of milk fat and renovated butter must not contain more than 16 per cent. of water.[2] There is no standard for moisture in the definition of butter but obviously it cannot contain much over 16 per cent.

The five samples which did not meet the above requirements are tabulated as follows:

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[1] Conn. Exp. Sta. Bull. 210, p. 212, (1918).

[2] State Regulation 48.

Butter Below Standard.

D.C. No.	Sold for	Dealer (New Haven).	Water. %	Curd, Salt, etc. %	Fat. %	Refraction, 25°C.
18105	"Undergrade" butter	J. L. Gold	28.44	1.28	70.28	53.1
16898	Sweet Butter	Morris Gold	22.08	77.92		50.6
18476	Renovated Butter	Morris Gold	29.77	0.93	69.30	52.3
16900	Sweet Butter	Liebmann & Gold	27.03	72.97		51.2
18302	Sweet Butter	Liebmann & Gold	28.71	1.18	70.11	53.0

The adulteration in the above cases consists of excess water and consequent deficiency of milk fat. Sample **18105** was sold for about one half the market price of butter and was marked undergrade so that its substance and quality were not misrepresented. Samples **16898, 18476, 16900** and **18302** were renovated.

Oleomargarine.

Five samples, all submitted by the Dairy and Food Commissioner, were examined for coloring matter, but no evidence of added dyestuffs was obtained. In no case was the product sold for butter.

Nut Margarine.

Two new brands of this product have been examined, **13963,** Delicia and **13971,** Palmine, both sold by Van Dyke's Tea Store, New Haven. The analyses of these brands and of eight brands previously reported[1] are given in Table VI.

GELATIN, ETC.

Seven unofficial samples of gelatin were submitted by the Dairy and Food Department for examination. Three of these were distinctly inferior products indicated by bad odor, high fat or high keratin, or both, and in one case by excessive arsenic content.

The data on these products are as follows:

Designation of sample	A 15	A 16	A 21
Total nitrogen	15.69%	15.23%	14.92%
Ash	1.90	2.95	2.84
Fat	0.17	0.30	0.45
Keratin	0.09	0.18	0.11
Arsenic	1:500,000	1:50,000	trace
Copper	none	none	....
Odor	disagreeable	slight	disagreeable
Water solution, cold	cloudy	very cloudy	cloudy
hot	clear	cloudy	....

The ash should not exceed 2 per cent., the fat and keratin should not be much in excess of 0.08 per cent. each, arsenic does not

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[1] Conn. Exp. Sta., Bull. 210 p. 203, (1918).

TABLE VI.—ANALYSES OF

Number.	Brand, Manufacturer or Dealer.	Moisture.
		%
8186	A 1. Downey Farrell Co., Chicago	10.84
8169	Cocoanut. Nucoa Butter Co., Soho Park, N. J.	6.53
8170	Providence Churning Co., Providence, R. I.	11.28
9883	Nut-ola. Armour Co.	9.44
9898	Gem. Swift & Co.	12.64
9911	Benefit. Sweet Nut Butter Co., Boston, Mass.	12.35
9937	Kingnut. Kellogg Products, Inc., Buffalo	10.12
9938	Nut Marigold. Marigold Margarine Fact. 5th Dist., N.J.	14.71
13963	Delicia. Van Dyke, New Haven	10.67
13971	Palmine. Van Dyke, New Haven	13.08

ordinarily exceed 1:700,000, a good product should be without odor, and the water solution should be clear.[1]

A product used as a substitute for gelatin in ice cream manufacture was also submitted, No. **16396**. This was found to consist chiefly of starch and Indian gum. Tests for gelatin and tragacanth were negative. The sample contained 2.48 per cent. of ash, 1.60 per cent. of nitrogen and 37.17 per cent. of starch.

ICE CREAM.

Chapter 260 of the Public Acts of 1919 regulates the manufacture and sale of ice cream in this State. It provides that the milk fat content of ice cream (plain) shall be not less than 8 per cent. and that of fruit and nut ice cream not less than 6 per cent. The presence of boric acid, salicylic acid, formaldehyde, saccharin, salts of copper, iron oxide, ochres and injurious colors or flavors in any ice cream is prohibited. Harmless permitted colors and harmless imitation flavors are allowed if their presence is declared. The use of harmless vegetable gums and gelatin is permitted; and ice cream containing less fat than that required by the standards may be manufactured and sold provided the true fat content is made know to the purchaser by suitable signs or labels.

The Dairy and Food Commissioner made a preliminary inspection last year and several hundred samples were taken. These were used as a basis for hearings to advise manufacturers and others

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[1] Conn. Exp. Sta. Bull 219 p. 221, (1919).

NUT MARGARINES.

Protein (Nx6.25).	Ash.	Fat.	Free Fatty Acids as Oleic.	Refractometer Reading at 40°C.	Reichert-Meissel No.	Halphen Test.	Nitric Acid Test.
%	%	%	%				
1.25	4.51	83.40	0.45	40.0	7.00	deep pink	brown
0.69	1.58	91.20	0.39	37.2	7.50	yellow	brown
0.75	1.14	86.83	0.47	39.0	6.15	yellow	yellow
2.71	6.06	81.75	0.25	39.0	6.37	yellow	......
1.36	2.91	83.09	0.95	40.0	6.69	pink	......
1.29	2.08	84.27	1.11	37.0	6.22	yellow	......
1.87	3.00	85.01	0.19	38.5	6.50	yellow	......
1.19	1.51	82.58	1.03	38.0	6.62	yellow	......
1.66	1.93	85.74	....	35.5	6.40	yellow	yellow
0.83	4.33	81.76	....	36.5	7.90	yellow	yellow

of the provisions of the law. Subsequently 82 official samples were taken of which only three were found to be below standard.

During the past year 47 cities and towns were visited and 400 samples collected. The distribution of the samples and results of analyses are given in the following summary.

	No. of Samples		
Kind of Ice Cream.	collected,	below standard.	Per cent. below standard.
Plain ice cream...........	331	45	13.6
Fruit ice cream...........	66	2	3.0
Nut ice cream............	3	0	0.0
Total....................	400	47	11.8

A comparison with the results obtained last year based upon the percentages of milk fat in the sample is as follows:

	1919		1920	
Range of Fat.	Samples.	Per cent.	Samples.	Per cent.
8 to 8.9	15	18.3	79	19.7
9 to 9.9	10	12.2	55	13.8
10 to 11.9	26	31.7	83	20.8
12 to 13.9	15	18.3	67	16.7
14 to 19.9	13	15.8	56	14.0
20 and above	0	....	2	0.5
Below 8.0	3	3.7	58*	14.5
Total	82	100.0	400	100.0

*Includes 11 fruit creams of legal standard.

The results of the inspection during the past year are given in detail in Table VII. Figures below 8 per cent. in the case of plain ice cream and below 6 per cent. in the case of fruit and nut creams appear in full face type.

TABLE VII.—ANALYSES OF ICE CREAM.

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	BRIDGEPORT.			
17346	J. E. Broderick	Stratford Candy Kitchen	Chocolate	12.2
17349	D. J. Broderick	Harris Hart	Chocolate	8.4
17340	Frank Cuneo	Own make	Chocolate	8.0
17345	Eagle Confectionery Co	Own make	Chocolate	9.2
18228	Sigmund Gerstl	Own make	Chocolate	8.0
18446	E. L. Graves	Own make	Chocolate	10.4
17347	Ideal Ice Cream Co	Stratford Ice Cream Co	Chocolate	8.0
17334	Lane Confectionery Co	Own make	Chocolate	13.2
17342	Andrew Musante	Own make	Chocolate	9.6
18440	New England Ice Cream Co	Own make	Chocolate	8.0
18443	George Nicholas	Own make	Chocolate	12.4
17337	Regas & Pappas	Own make	Chocolate	9.2
18225	Royal Candy Kitchen	Own make	Chocolate	11.2
18449	Strand Confectionery Co	Own make	Chocolate	8.4
18223	George Casrientes	Own make	Strawberry	3.6
18226	Crystal Palace Conf. Co	Own make	Strawberry	11.4
18447	E. L. Graves	Own make	Strawberry	10.4
17335	Lane Confectionery Co	Own make	Strawberry	10.8
17343	Andrew Musante	Own make	Strawberry	6.8
18441	New England Ice Cream Co	Own make	Strawberry	9.6
18444	George Nicholas	Own make	Strawberry	12.0
17338	Regas & Pappas	Own make	Strawberry	11.2
18222	Crystal Palace Conf. Co	Own make	Vanilla	10.8
17339	Frank Cuneo	Own make	Vanilla	8.8
17334	Eagle Confectionery Co	Own make	Vanilla	8.0
18227	Sigmund Gerstl	Own make	Vanilla	10.0
18445	E. L. Graves	Own make	Vanilla	11.2
17331	Horsoof Kachbourian	Huber Ice Cream Co	Vanilla	10.4
17333	Lane Confectionery Co	Own make	Vanilla	12.4
17341	Andrew Musante	Own make	Vanilla	8.8
18439	New England Ice Cream Co	Own make	Vanilla	10.0
18442	George Nicholas	Own make	Vanilla	11.6
18229	Frank Ostrofsky	Own make	Vanilla	5.4
17332	The Park Spa	Huber Ice Cream Co	Vanilla	10.4
17336	Regas & Pappas	Own make	Vanilla	10.0
18224	Royal Candy Kitchen	Own make	Vanilla	9.4
17325	Louis Slavin	New England Ice Cream Co	Vanilla	8.8
18448	Strand Confectionery Co	Own make	Vanilla	11.6
	Average			9.7
	BRISTOL.			
17929	Bristol Candy Kitchen	Own make	Chocolate	12.0
17919	J. A. Kennedy	New Haven Dairy	Chocolate	8.0
17925	Palace of Sweets	Own make	Chocolate	15.6
17923	St. Clair Confectionery Co	Own make	Chocolate	14.2
17928	Bristol Candy Kitchen	Own make	Strawberry	11.6
17926	Bristol Candy Kitchen	Own make	Vanilla	12.8

Table VII.—Analyses of Ice Cream.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	Bristol—(*concluded*).			
17920	J. A. Kennedy	New Haven Dairy Co	Vanilla	9.0
17924	Palace of Sweets	Own make	Vanilla	15.0
17922	St. Clair Confectionery Co	Own make	Vanilla	14.4
	Average			12.5
	Cos Cob.			
18205	M. Taylor	Horton Ice Cream Co	Strawberry	8.0
18204	M. Taylor	Horton Ice Cream Co	Vanilla	8.0
	Average			8.0
	Danbury.			
17319	Danbury Candy Co	Own make	Chocolate	9.0
18257	H. E. Northrop	Own make	Chocolate	12.4
17320	D. F. Stevens	Own make	Chocolate	7.0
18252	Athan & Nicholson	Own make	Strawberry	8.0
18254	Charles Ryder Ice Cream Co	Own make	Strawberry	10.0
18255	Charles Ryder Ice Cream Co	Own make	Strawberry	11.2
17318	Danbury Candy Co	Own make	Vanilla	10.0
18251	Athan & Nicholson	Own make	Vanilla	8.0
18253	Charles Ryder Ice Cream Co	Own make	Vanilla	10.4
17321	D. F. Stevens	Own make	Vanilla	8.0
	Average			9.4
	Danielson.			
18084	Mary Salotti	Own make	Chocolate	9.4
17763	Ephrem Auger	J. H. Bouthillier	Coffee	6.4
16848	Cola Bros	Own make	Coffee	8.4
17762	Ephrem Auger	J. H. Bouthillier	Strawberry	6.8
18083	Mary Salotti	Own make	Strawberry	8.4
17761	Ephrem Auger	J. H. Bouthillier	Vanilla	11.4
18206	George Berris	New Haven Dairy	Vanilla	9.6
16847	Cola Bros	Own make	Vanilla	8.0
18100	Mary Salotti	Own make	Vanilla	9.0
17764	A. P. Woodward	Own make	Vanilla	7.4
	Average			8.5
	East Port Chester			
18273	J. Tuchim	Neilsons	Chocolate	8.0
18274	J. Tuchim	Neilsons	Strawberry	8.0
18300	J. Tuchim	Neilsons	Vanilla	9.0
	Average			8.3
	Fairfield.			
18260	Henderson Bros	Huber Ice Cream Co	Chocolate	9.4
17350	Henderson Bros	Huber Ice Cream Co	Vanilla	10.8
	Average			10.1

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	FARMINGTON.			
17501	Frederick Swanston	Hackney	Chocolate	8.4
17502	Frederick Swanston	Hackney	Vanilla	6.3
	Average			7.3
	FORESTVILLE.			
17917	Purity Ice Cream Co	Own make	Chocolate	6.1
17913	White Rock Ice Cream Co	Own make	Chocolate	9.8
17915	White Rock Ice Cream Co	Own make	Maple	9.2
17918	Purity Ice Cream Co	Own make	Strawberry	8.0
17914	White Rock Ice Cream Co	Own make	Strawberry	9.4
17911	James Holden	White Rock Ice Cream Co	Vanilla	10.0
17916	Purity Ice Cream Co	Own make	Vanilla	9.6
17912	White Rock Ice Cream Co	Own make	Vanilla	10.5
	Average			9.1
	GREENWICH.			
18291	Greenwich Drug Store	Horton Ice Cream Co	Chocolate	6.6
18289	Finch's Pharmacy	Horton Ice Cream Co	Chocolate	8.3
18282	J. H. Hall	Own make	Chocolate	8.8
18280	Kataris & Joseph	Own make	Chocolate	8.2
18287	A. B. Libano	Own make	Chocolate	8.2
18202	Pickwick Shop	Own make	Chocolate	15.0
18203	Pickwick Shop	Own make	Coffee	13.2
18283	J. H. Hall	Own make	Strawberry	8.0
18278	L. Kataris	Own make	Strawberry	8.4
18286	W. B. Libano	Own make	Strawberry	8.0
18276	Frank Zamfino	Own make	Strawberry	7.2
16168	Boswell Drug Co	Horton Ice Cream Co	Vanilla	8.6
18292	Boswell Drug Co	Horton Ice Cream Co	Vanilla	5.8
18288	W. E. Fitch's Pharmacy	Horton Ice Cream Co	Vanilla	8.0
18290	Greenwich Drug Store	Horton Ice Cream Co	Vanilla	8.0
18281	J. H. Hall	Own make	Vanilla	10.0
18277	L. Kataris	Own make	Vanilla	10.8
18279	Kataris & Joseph	Own make	Vanilla	8.0
18289	A. B. Libano	Own make	Vanilla	13.2
18201	Pickwick Shop	Own make	Vanilla	14.4
18275	Frank Zamfino	Own make	Vanilla	7.9
	Average			9.7
	GROTON.			
18689	Scuris Bros	Own make	Chocolate	7.2
18688	Scuris Bros	Own make	Vanilla	8.4
	Average			7.8

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	HARTFORD.			
18092	Thomas Appell	Own make	Chocolate	9.0
17904	Atlas Confectionery Co	Own make	Chocolate	8.8
17852	Besse	Own make	Chocolate	10.4
18096	Crown Confectionery Co	Own make	Chocolate	11.6
17902	Eagle Confectionery Co	Own make	Chocolate	14.4
17854	Goodwin Drug Co	Own make	Chocolate	11.2
17905	Goodwin Drug Co	Own make	Chocolate	9.2
17909	A. P. Leonard	Own make	Chocolate	14.0
18097	Liberty Confectionery Co	Own make	Chocolate	10.8
17859	Palace of Sweets	Own make	Chocolate	14.4
18089	Royal Candy Kitchen	Own make	Chocolate	9.6
17908	J. P. Treautafelacos	Own make	Chocolate	13.0
18093	Thomas Appell	Own make	Strawberry	9.0
18098	Crown Confectionery Co	Own make	Strawberry	12.8
17855	Goodwin Drug Co	Own make	Strawberry	11.2
18099	Liberty Confectionery Co	Own make	Strawberry	11.4
18090	Royal Candy Co	Own make	Strawberry	11.2
18091	Thomas Appell	Own make	Vanilla	11.2
17903	Atlas Confectionery Co	Own make	Vanilla	12.6
17851	Besse	Own make	Vanilla	12.0
18094	Crown Confectionery Co	Own make	Vanilla	13.2
17901	Eagle Confectionery Co	Own make	Vanilla	16.0
17853	Goodwin Drug Co	Own make	Vanilla	11.6
17906	Goodwin Drug Co	Own make	Vanilla	11.2
17910	A. P. Leonard	Own make	Vanilla	15.4
18095	Liberty Confectionery Co	Own make	Vanilla	8.4
17857	Newton Robinson & Co	Own make	Vanilla	8.2
17858	Palace of Sweets	Own make	Vanilla	15.2
18088	Royal Candy Co	Own make	Vanilla	10.0
17907	J. P. Treautafelacos	Own make	Vanilla	11.2
17856	Wise, Smith & Co	Hartford Ice Cream Co	French Vanilla	12.4
	Average			11.6
	JEWETT CITY.			
17773	Fred Maynard	Own make	Chocolate	7.6
18284	Alleandro Pieraccini	Own make	Chocolate	5.6
17775	Dennis J. Sullivan	Own make	Chocolate	9.0
17774	Dennis J. Sullivan	Own make	Lemon	8.8
18230	Alleandro Pieraccini	Own make	Vanilla	6.7
17772	Fred Maynard	Own make	Vanilla	11.8
	Average			8.3
	KILLINGLY.			
17899	Fred Espinosa	Own make	Coffee	4.8
17900	Fred Espinosa	Own make	Vanilla	6.0
	Average			5.4
	MANCHESTER.			
17843	Manchester Dairy Ice Cream Co.	Own make	Chocolate	9.4
17845	Manchester Dairy Ice Cream Co.	Own make	Coffee	11.6
17844	Manchester Dairy Ice Cream Co.	Own make	Strawberry	12.0
17842	Manchester Dairy Ice Cream Co.	Own make	Vanilla	12.0
	Average			11.2

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	MERIDEN.			
17279	Allis Bros	Own make	Caramel	14.6
17281	Albert Eichorn	Own make	Cherry Bisque	9.6
17278	Allis Bros	Own make	Chocolate	13.6
17284	Clarence Katt	Own make	Chocolate	11.8
17288	New Haven Dairy Plant	Own make	Chocolate	10.6
17282	Albert Eichorn	Own make	Maple Nut	13.6
17286	J. F. Furman	Own make	Strawberry	7.2
17285	Clarence Katt	Own make	Strawberry	10.8
17289	New Haven Dairy Plant	Own make	Strawberry	9.2
17290	New Haven Dairy Plant	Own make	Tutti Fruitti	9.0
17277	Allis Bros	Own make	Vanilla	15.4
17280	Albert Eichorn	Own make	Vanilla	14.8
17292	Mrs. Sarah Furman	J. F. Furman	Vanilla	6.0
17283	Clarence Katt	Own make	Vanilla	11.0
17287	New Haven Dairy Plant	Own make	Vanilla	9.6
	Average			11.1
	MILFORD.			
17348	Ideal Ice Cream Co	Stratford Ice Cream Co	Vanilla	11.6
	MOOSUP.			
17768	Habbib Abbood	Own make	Chocolate	1.2
17771	F. W. Daggett	Own make	Coffee	15.6
17767	Habbib Abbodd	Own make	Vanilla	5.4
17769	Devisso & Co	Connie McGaughery	Vanilla	8.2
	Average			7.6
	MYSTIC.			
18691	Peter Hammecher	Own make	Chocolate	12.0
18695	E. W. Haskell	Own make	Coffee	12.4
18693	John Wheeler	Own make	Coffee	18.0
18694	E. W. Haskell	Own make	Vanilla	13.6
18690	Peter Hammecher	Own make	Vanilla	15.2
18692	John Wheeler	Own make	Vanilla	20.0
	Average			15.2
	NEW BRITAIN.			
17880	Louis Gourson	Hartford Ice Cream Co	Chocolate	8.8
17308	C. E. McEnroe	Own make	Chocolate	13.6
17883	John Contaris	Own make	Chocolate	11.6
17305	St. Clair Confectionery Co	Own make	Chocolate	11.6
17302	Star Confectionery Co	Own make	Chocolate	12.8
17306	St. Clair Confectionery Co	Own make	Strawberry	12.0
17303	Star Confectionery Co	Own make	Vanilla	17.0
17882	John Contaris	Own make	Vanilla	12.4
17881	Edith Kopel	New Haven Dairy	Vanilla	9.2
17307	C. E. McEnroe	Own make	Vanilla	13.6
17304	St. Clair Confectionery Co	Own make	Vanilla	11.6
17301	Star Confectionery Co	Own make	Vanilla	13.6
	Average			12.3

Table VII.—Analyses of Ice Cream.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	New Haven.			
17315	John Basel	Own make	Chocolate	7.4
17255	Davis Drug Co	New Haven Dairy	Chocolate	9.2
17258	Huylers	Own make	Chocolate	14.4
17257	Liggett Drug Co	Semon Ice Cream Co	Chocolate	8.4
18460	New Haven Dairy Co	Own make	Chocolate	7.6
17262	Petersons	New Haven Dairy	Chocolate	10.2
17310	Theodore Tramis	Own make	Chocolate	8.4
17310	Peter Vallani	Own make	Chocolate	8.5
17311	Peter Vallani	Own make	Peach	6.4
17316	John Basel	Own make	Strawberry	7.0
17261	Huylers	Own make	Strawberry	12.0
18461	New Haven Dairy	Own make	Strawberry	8.0
17314	John Basel	Own make	Vanilla	7.3
17354	Davis Drug Co	New Haven Dairy	Vanilla	9.9
17259	Huylers	Own make	Vanilla	11.8
17256	Liggett Drug Co	Semon Ice Cream Co	Vanilla	9.4
18462	New Haven Dairy	Own make	Vanilla	8.4
17260	Petersons	New Haven Dairy	Vanilla	11.0
17296	Theodore Tramis	Own make	Vanilla	8.0
17309	Peter Vallani	Own make	Vanilla	9.6
	Average			9.1
	New London.			
18687	Dimon Ballassi	Own make	Chocolate	16.4
18671	Conti Bros	Own make	Chocolate	8.4
18665	George Kozinos	Own make	Chocolate	13.6
18673	Johns & Manabas	Own make	Chocolate	14.0
18669	Peter Lalaty	Own make	Chocolate	11.8
18685	Basil D. Nichols	Own make	Chocolate	12.8
18623	Emanual Nichols	Own make	Chocolate	15.2
18675	S. F. Peterson	Own make	Chocolate	15.2
18677	Socrates Peterson	Own make	Chocolate	12.8
18675	E. E. Stratas	Own make	Chocolate	13.0
18681	Mohican Hotel	Own make	Coffee	13.2
18667	Abraham J. Maloof	Own make	Lemon	11.2
18686	Dimon Ballassi	Own make	Vanilla	17.0
18670	Conti Bros	Own make	Vanilla	11.2
18664	George Kozinos	Own make	Vanilla	15.6
18672	Johns & Manabas	Own make	Vanilla	14.0
18668	Peter Lalaty	Own make	Vanilla	13.6
18666	Abraham J. Maloof	Own make	Vanilla	11.2
18680	Mohican Hotel	Own make	Vanilla	22.0
18684	Basil D. Nichols	Own make	Vanilla	14.0
18682	Emanual Nichols	Own make	Vanilla	15.6
18676	Socrates Peterson	Own make	Vanilla	13.6
18674	S. F. Peterson	Own make	Vanilla	17.2
18678	E. E. Stratas	Own make	Vanilla	13.8
	Average			14.4

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	NORWALK.			
18298	Combis Candy Kitchen	DeKlym	Chocolate	8.0
18265	M. Cowas	Own make	Chocolate	8.0
18271	Cochinos & Notis	Own make	Chocolate	13.2
16170	Solomon Hatten	Horton Ice Cream Co	Chocolate	8.4
18293	C. DeKlym	Own make	Chocolate	8.0
18268	Zapperson & Pappas	Own make	Chocolate	12.4
18272	Cochinos & Notis	Own make	Coffee	13.2
18299	Combis Candy Kitchen	Own make	Strawberry	8.0
18266	M. Cowas	Own make	Strawberry	8.0
16171	Solomon Hatten	Horton Ice Cream Co	Strawberry	7.9
18296	C. DeKlym	Own make	Strawberry	7.2
18269	Zapperson & Pappas	Own make	Strawberry	9.6
18270	Cochinos & Notis	Own make	Vanilla	13.2
18297	Combis Candy Kitchen	DeKlym	Vanilla	8.4
18264	M. Cowas	Own make	Vanilla	9.2
18395	C. DeKlym	Own make	Vanilla	8.0
18267	Zapperson & Pappas	Own make	Vanilla	11.6
	Average			9.5
	NORWICH.			
18245	Tilly D. Becker	Own make	Chocolate	12.4
17792	Christ. Bell	Own make	Chocolate	17.0
17787	John A. Johnson	Own make	Chocolate	7.6
17790	Lagos Bros	Own make	Chocolate	8.2
17794	Stavros Peterson	Own make	Chocolate	13.0
17783	Peter Sellis	Own make	Chocolate	6.4
17785	Crystal Confectionery Co.	Own make	Coffee	9.0
18244	Tilly D. Becker	Own make	Strawberry	16.8
17798	George Conlopoulus	Own make	Strawberry	9.6
17781	Peter Constandi	Own make	Strawberry	10.2
17796	James Ganosel	Own make	Strawberry	15.4
17791	Christ. Bell	Own make	Vanilla	18.0
17784	Crystal Confectionery Co.	Own make	Vanilla	8.8
17780	Peter Constandi	Own make	Vanilla	8.2
17797	George Conlopoulus	Own make	Vanilla	9.0
17795	James Ganosel	Own make	Vanilla	15.4
17786	John Johnson	Own make	Vanilla	8.6
17789	Lagos Bros.	Own make	Vanilla	12.8
17788	Prekaris Bros	Own make	Vanilla	5.7
17793	Stravros Peterson	Own make	Vanilla	16.0
17782	Peter Sellis	Own make	Vanilla	9.8
	Average			11.3
	NORTH GROSVENORDALE.			
17751	W. B. Chandler	Nectar Products Co	Chocolate	12.4
16850	Theophelus Donville	Own make	Strawberry	8.8
17752	W. B. Chandler	Nectar Products Co	Vanilla	9.2
16849	Theophelus Donville	Own make	Vanilla	8.4
	Average			9.7

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	PAWCATUCK.			
18242	John D. Traggis	Own make	Chocolate	12.8
18243	John Traggis	Own make	Coffee	15.2
18241	Charles Vardilos	Own make	Coffee	15.6
18240	Charles Vardilos	Own make	Vanilla	15.2
	Average			14.7
	PUTNAM.			
17756	Strombelis Bros	Progress Mfg Co.	Chocolate	9.0
17760	J. E. Talbot	Own make	Chocolate	5.0
17758	Ernest Whittemore	Smith Bros	Chocolate	10.8
17754	James Ryan	Anderson & Patterson	Strawberry	10.4
17753	James Ryan	Anderson & Patterson	Vanilla	12.8
17755	Strombelis Bros	Progress Mfg. Co.	Vanilla	9.6
17749	J. E. Talbot	Own make	Vanilla	5.3
17757	Ernest Whittemore	Smith Bros	Vanilla	11.8
	Average			9.3
	ROCKVILLE.			
18002	John E. Gawtrey	Own make	Chocolate	4.7
17847	Palace of Sweets	Own make	Chocolate	13.8
17850	Mary Cuneo	Tait Bros	Coffee	9.2
18004	John Gawtrey	Own make	Coffee	4.2
18005	Mary Cuneo	Tait Bros	Pineapple	8.4
18748	Palace of Sweets	Own make	Strawberry	14.8
18003	John E. Gawtrey	Own make	Strawberry	2.8
17849	Mary Cuneo	Tait Bros	Vanilla	11.2
17846	Palace of Sweets	Own make	Vanilla	14.4
18001	John Gawtrey	Own make	Vanilla	3.9
	Average			8.7
	SOMERS.			
18007	Grace Holmes	Own make	Strawberry	10.0
18006	Grace Holmes	Own make	Vanilla	13.2
	Average			11.6
	SOMERSVILLE.			
18009	Homer Ice Cream Co	Own make	Chocolate	10.4
18008	Homer Ice Cream Co	Own make	Vanilla	13.2
	Average			11.8
	SOUTH MANCHESTER.			
17839	Mamacos & Ambulos	Own make	Chocolate	13.6
17841	Mamacos & Ambulos	Own make	Coffee	14.0
17840	Mamacos & Ambulos	Own make	Strawberry	13.6
17838	Mamacos & Ambulos	Own make	Vanilla	14.8
		Average		14.0
	SOUTH NORWALK.			
18428	New England Candy Co	Own make	Chocolate	12.0
18426	Charles Thomas	Own make	Chocolate	12.0

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	SOUTH NORWALK—(*concluded*).			
18431	Henry Wilkins	Own make	Chocolate	1.2
18434	Henry Wilkins	Own make	Chocolate	4.5
18427	Charles Thomas	Own make	Peach	10.0
18429	Plainsted Drug Store	DeKlym	Vanilla	10.0
18425	Charles Thomas	Own make	Vanilla	11.0
18430	Henry Wilkins	Own make	Vanilla	3.6
18432	Henry Wilkins	Own make	Vanilla	3.4
18433	Henry Wilkins	Own make	Vanilla	2.5
	Average			7.0
	SOUTHPORT.			
18262	M. R. Perry	Semon Ice Cream Co	Chocolate	10.0
18261	M. R. Perry	Semon Ice Cream Co	Vanilla	10.4
18263	M. Switzer	Horton Ice Cream Co	Vanilla	8.6
	Average			9.7
	STAMFORD.			
18213	G. K. Lawrence	Own make	Chocolate	11.0
16169	Xanthos Candy Co	Own make	Chocolate	13.2
18209	United Candy Co	Own make	Chocolate	8.6
18215	Eagle Candy Co	Own make	Chocolate	14.0
18217	Mazza & Co	Own make	Chocolate	4.9
18219	Olympia Confect. Co	Own make	Strawberry	11.2
18211	Xanthos Candy Co	Own make	Strawberry	12.4
18214	Eagle Candy Co	Own make	Vanilla	15.2
18216	Mazza & Co	Own make	Vanilla	5.2
18212	G. K. Lawrence	Own make	Vanilla	14.0
18221	G. K. Lawrence	Own make	Vanilla	13.4
18220	G. Scannalle	Own make	Vanilla	6.2
18207	Paul Sabini	Star Confectionery Co	Vanilla	8.0
18218	Olympia Confect. Co	Own make	Vanilla	11.2
18208	United Candy Co	Own make	Vanilla	9.2
18210	Xanthos Candy Co	Own make	Vanilla	12.8
	Average			10.6
	STONINGTON.			
18698	Victor Danesi	Maine Creamery Co	Chocolate	7.8
18239	Francis D. Burtch	Own make	Chocolate	15.8
18699	Victor Danesi	Maine Creamery Co	Coffee	8.4
18697	Paul Schepis	Dolby Ice Cream Co	Coffee	11.0
18238	Francis Burtch	Own make	Vanilla	13.6
18696	Paul Schepis	Dolby Ice Cream Co	Vanilla	10.2
	Average			11.1

TABLE VII.—ANALYSES OF ICE CREAM.—*Continued.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	STRATFORD.			
17327	Stratford Candy Kitchen	Own make	Chocolate	8.8
17328	Stratford Candy Kitchen	Own make	Strawberry	11.6
17326	Stratford Candy Kitchen	Own make	Vanilla	12.8
	Average			11.1
	SUFFIELD.			
17867	George Martinez	New Haven Dairy	Chocolate	8.4
17870	F. H. Reid	Own make	Chocolate	8.0
17869	F. H. Reid	Own make	Strawberry	6.4
17866	George Martinez	New Haven Dairy	Vanilla	9.6
17868	F. H. Reid	Own make	Vanilla	10.8
17871	Peter Janik	Tait Bros	Vanilla	10.0
	Average			8.9
	THOMPSONVILLE.			
18010	Harry Zirolli	Tait Bros	Chocolate	9.2
18013	Rice Bros	Own make	Chocolate	12.4
18014	Rice Bros	Own make	Strawberry	10.0
18011	Harry Zirolli	Tait Bros	Strawberry	9.2
18015	F. Athen & J. Devine	New Haven Dairy	Vanilla	8.6
18016	M. J. Dineen	Own make	Vanilla	15.2
18012	Rice Bros	Own make	Vanilla	13.2
	Average			11.1
	TORRINGTON.			
16645	Torrington Creamery	Own make		9.2
16646	Torrington Creamery	Own make		9.0
	Average			9.1
	UNCASVILLE.			
17799	Pappas Bros	Own make	Vanilla	8.8
	UNIONVILLE.			
17504	Hackney Ice Cream Co	Own make	Chocolate	7.1
17865	Hackney Ice Cream Co	Own make	Chocolate	8.0
17861	Heiman Ice Cream Co	Own make	Chocolate	9.0
17863	Heiman Ice Cream Co	Own make	Maple Nut	9.6
17505	Hackney Ice Cream Co	Own make	Strawberry	6.8
17862	Heiman Ice Cream Co	Own make	Strawberry	11.2
17864	Heiman Ice Cream Co	Own make	Vanilla	10.6
17503	Hackney Ice Cream Co	Own make	Vanilla	9.6
17860	Heiman Ice Cream Co	Own make	Vanilla	10.6
	Average			9.2
	WALLINGFORD.			
17294	Ally & David	Own make	Chocolate	11.2
17295	Ally & David	Own make	Strawberry	11.8
17293	Ally & David	Own make	Vanilla	13.2
	Average			12.1

TABLE VII.—ANALYSES OF ICE CREAM.—*Concluded.*

D. C. No.	Dealer.	Manufacturer.	Flavor.	Fat. %
	WAUREGAN.			
18658	John Albro	Own make	Chocolate	6.8
17765	Harmidos Wilmot	Own make	Coffee	6.4
18657	John Albro	Own make	Vanilla	8.0
17766	Harmidos Wilmot	Own make	Vanilla	7.2
	Average			7.1
	WEST HAVEN.			
17929	J. D. Illions	Semon Ice Cream Co	Chocolate	8.6
17931	Fred LeVere	Harris Hart Ice Co	Chocolate	8.4
17934	Nicholas Parela	Semon Ice Cream Co	Chocolate	9.2
17933	Harry Pite	New Haven Dairy Co	Chocolate	9.6
17932	Fred LeVere	Harris Hart Ice Cream Co	Strawberry	9.2
17930	Fred LeVere	Harris Hart Ice Cream Co	Vanilla	9.6
	Average			9.1
	WESTPORT.			
18294	J. J. O'Connor	DeKlym	Chocolate	8.4
	WILLIAMANTIC.			
16839	Hallock & Holbrook	Own make	Chocolate	16.0
16846	Patrick McDermott	Horton Ice Cream Co	Chocolate	5.0
16845	Peter Yanclas	Own make	Chocolate	13.4
16840	Hallock & Holbrook	Own make	Coffee	16.4
16806	William Morris	Own make	Coffee	15.2
16841	Styles Sisters	Own make	Peach	11.6
16837	William Morris	Own make	Strawberry	15.6
16838	Hallock & Holbrook	Own make	Vanilla	16.0
16835	William Morris	Own make	Vanilla	15.6
16842	Styles Sisters	Own make	Vanilla	15.8
16844	Peter Yanclas	Own make	Vanilla	14.4
	Average			14.1
	WINDSOR LOCKS.			
17877	Charles Colli	Homer Ice Cream Co	Chocolate	12.4
17872	Louis Molinari	Peter Fossa	Chocolate	8.8
17875	Vito Colapietro	Own make	Chocolate	7.5
17876	Vito Colapietro	Own make	Maple Nut	6.8
17874	Vito Colapietro	Own make	Vanilla	8.8
17879	Vito Colapietro	Own make	Vanilla	3.2
17873	Louis Molinari	Peter Fossa	Vanilla	9.6
17878	Charles Colli	Homer Ice Cream Co	Vanilla	13.2
	Average			8.8
	Average of State			10.1

The averages given for each city or town do not of course adequately represent the true conditions in the several localities. Data as to the gross sales of the various grades is necessary to show the true average quality available. For the same reason the average for the total number of samples does not properly represent the average market condition in the State; and the double standard further complicates the calculation. The larger manufacturers have naturally standardized their products at a figure close to the legal standard and their combined output constitutes the greater part of the gross supply. Of the smaller producers many, no doubt, are unwittingly furnishing rich cream through lack of careful factory control while others may be intentionally supplying an extra quality product to a limited or special class of trade. At any rate the figures show many samples testing well in excess of 8 per cent. and the average of all samples collected is 10.1 per cent.

Forty-seven samples, or 11.8 per cent. of the total number were below standard.

Of 4 samples submitted by individuals 1 was below standard.

MILK AND MILK PRODUCTS.

MARKET MILK.

Ten hundred and fifty-four samples of market milk have been examined for the Dairy and Food Commissioner, classified as follows:

Not found adulterated	752	71.4%
Adulterated by dilution with water	58	5.5
Adulterated by skimming	18	1.8
Adulterated by reason of being:		
below standard in solids and solids-not-fat	100	9.4
below standard in solids and fat	19	1.8
below standard in solids, fat and solids-not-fat	107	10.1
Total	1054	100.0

The number of samples found diluted with water is conspicuously less than in preceding years. Our data with respect to the quality of milk by official inspection summarized for the periods 1913 to 1917 inclusive and 1918 to 1920 inclusive are as follows:

	Period 1913-1917.		Period 1918-1920.	
Not found adulterated	815	43.0%	2246	60.9%
Adulterated by dilution with water	276	14.5	367	9.9
Adulterated by skimming	37	1.9	131	3.6
Otherwise adulterated or below standard	770	40.6	946	25.6
Total	1,898	100.0	3,690	100.0

This summarizes the history of the inspection of market milk for the past eight years and indicates a substantial improvement in the quality of this important product. This summary does not adequately represent the general quality of the milk in the State for the reason that, as we have stated previously, official samples, in perhaps the majority of cases, are taken upon suspicion of inferiority or adulteration and in response to complaints of local milk inspectors, health officers or dairy technicians. It is reasonable to presume therefor, that the average quality of milk sold in the State as a whole is better than the above figures indicate.

Samples found adulterated during the past year, other than those below standard are given in Table VIII.

MILK SUBMITTED BY INDIVIDUALS.

One hundred and two samples of milk were examined for consumers, producers and others of which seventy-five were passed and twenty-seven were adulterated or below standard. None of these require particular comment.

CREAM.

Two samples were submitted by the Dairy and Food Commissioner and four by individuals.

TESTER'S LICENSE.

Four samples of cream and two samples of milk have been examined to check candidates for certificates as provided in Sec. 2, Chapter 221, Public Acts of 1917.

IMITATION MILK, ETC.

13975. *Super-Cream.* Walter Jahn's "Super-Cream" made by the Rico Milk Products Co., East Troy, Wisconsin. Stated to contain at least 24 per cent. butter fat, and 31 per cent. total solids. Price 27 cents per can containing 7.5 ozs.

Analysis showed the following composition:

	As Sold.	Diluted with 5 parts water (calc.).
Solids	31.56%	5.26%
Ash	0.67	0.11
Protein	3.06	0.51
Sugar	3.83	0.64
Fat	24.00	4.00
Net weight	7.5 ozs.	....

The composition as stated on the label is substantiated by the analysis. However, the statement, which appears on the label, that "Super-Cream can be used wherever a rich milk is desired by the addition of five parts of water" is misleading. Such dilution would yield a product which approaches rich milk only as regards

TABLE VIII.—ADULTERATED MILK.

No.	Dealer.	Solids.	Fat.
	Containing Added Water		
	ANDOVER.		
17455	Frank Swartz..........	9.93	3.4
	BRANFORD.		
16338	E. W. Caldwell.........	10.19	3.2
16345	E. M. Yale............	10.35	3.4
16346	E. M. Yale............	10.59	3.2
16347	E. M. Yale............	10.83	3.4
	BRISTOL.		
14989	A. H. LaLane.........	11.27	3.4
	DURHAM.		
16306	David Bros............	10.54	3.1
16307	David Bros............	10.66	3.2
16308	David Bros............	11.52	3.8
16309	David Bros............	10.77	3.2
16310	David Bros............	9.77	3.2
	ELMWOOD.		
17999	Elmwood Catholic Ch....	9.55	3.0
	MILFORD.		
18504	Cecil Clark............	10.12	3.1
18505	Cecil Clark............	9.86	2.8
18507	Antonio Negosmeki.....	10.68	3.4
	NEWINGTON.		
18472	Wm. Bishop...........	10.52	3.4
18473	Wm. Bishop...........	11.06	3.6
18474	Wm. Bishop...........	10.68	3.3
	NEWTOWN.		
16320	Frank Valalik..........	10.71	3.2
16321	Frank Valalik..........	10.44	3.2
16322	Frank Valalik..........	9.87	2.6
	NORWICH.		
18783	Herbert Gardner.......	6.97	2.5
18784	Herbert Gardner.......	11.90	4.4
16786	John McLean..........	9.35	3.0
	ORANGE.		
16348	Benj. Hempstead.......	9.20	3.4
16126	M. DeCaprio..........	10.61	3.2
16342	Modestino DeCaprio....	10.59	3.2
	SOUTHBURY.		
15344	H. M. Cassidy.........	10.18	2.8
16118	Thos. Lovedale........	11.27	3.6
	Containing Added Water. *—continued.*		
	SOUTHINGTON.		
18479	Mrs. Neils Johnson.....	10.17	3.6
	SOUTH NORWALK.		
18526	Fred Frillow...........	10.49	3.2
	TORRINGTON.		
15629	Fred Lehman...........	11.64	4.0
16617	F. B. Woodward.......	11.57	3.7
16618	F. B. Woodward.......	10.98	3.4
16612	Chas. Zangg...........	11.64	3.8
	TRUMBULL.		
16333	Andrew Persztai........	9.63	2.9
	WALLINGFORD.		
17638	Wilbur C. Fenn........	10.53	3.2
17355	W. J. Self.............	9.61	3.2
17356	W. J. Self.............	9.47	3.0
17357	W. J. Self.............	10.30	3.6
17358	W. J. Self.............	10.07	3.6
17359	W. J. Self.............	10.47	3.6
	WATERBURY.		
17380	D. M. Rogers..........	10.83	3.3
	WATERTOWN.		
17484	John Popow...........	7.63	2.5
17485	John Popow...........	8.60	3.1
17486	John Popow...........	8.34	2.8
17487	John Popow...........	8.86	3.0
	WEST HARTFORD.		
18450	W. F. Brewer..........	9.81	2.4
15540	Ralph Gerth...........	11.15	3.5
18452	A. M. Morrell.........	6.93	1.4
	WESTPORT.		
14986	Leonard Gault.........	10.19	3.2
16397	Leonard Gault.........	9.34	3.2
16398	Lenoard Gault.........	10.07	3.2
16399	Leonard Gault.........	8.54	2.6
16400	Leonard Gault.........	9.95	3.0
	WILLIMANTIC.		
18981	John W. Gilman.......	10.33	3.3
18978	L. P. Oehrig...........	9.61	2.7
18979	L. P. Oehrig...........	9.61	2.9

TABLE VIII.—ADULTERATED MILK.—*Concluded.*

No.	Dealer.	Solids.	Fat.	No.	Dealer.	Solids.	Fat.
	Skimmed Milk				*Skimmed Milk—Concluded.*		
	ANSONIA.						
16468	Presto Lunch	11.25	2.3		NORWICH.		
				18761	Boston Cafe	11.07	1.8
	EAST CANAAN.			18763	Wauregan Hotel	11.96	3.1
16545	S. Serlin	10.71	2.2				
					PLANTSVILLE.		
	DANIELSON.			16244	Stanley Tycz	9.96	1.8
18965	W. S. Brown	10.22	1.7				
					PUTNAM.		
	MOOSUP.			18968	H. Callas & G. Anas	11.72	2.9
18961	Joseph Cournoier	11.02	2.5	18966	Delvina Thereault	9.75	1.1
	NAUGATUCK.				TORRINGTON.		
15692	J. Daily	10.79	2.3	15220	F. J. Barton	12.81	3.3
	NEW LONDON.				WILLIMANTIC.		
18708	Far East Lunch	9.47	1.1	18984	H. Israel & Son	11.28	2.5
18709	New China Co.	9.82	1.5	18982	J. T. Nichols	11.17	2.7
18704	N. Y., N. H. & H. R.R. Co.'s Restaurant	9.62	1.2	18980	T. F. Shea	10.66	1.7
18718	Sea Food Lunch	8.90	0.9				

fat content as shown by the calculated analysis. The diluted product would be watered cream, not rich milk.

13175. *En-Zo.* "Imitation Milk. A compound of evaporated skimmed milk and refined cocoanut fat". Stated to contain 6.1 per cent. vegetable fat and 24 per cent. total solids. Made by the Enzo Company, Denmark, Wisconsin.

13970. *Carolene.* "A compound of refined nut oils and evaporated skimmed milk." The label also states that the product is composed of "fresh cow's milk, butter fat removed and highly refined cocoanut oil substituted", and that it contains 24 per cent. solids and 6 per cent. refined nut oils. Made by The Carolene Co., Inc., 130 No. Wells St., Chicago.

These products are of the same type as Hebe, a sample of which has already been examined in this laboratory.[1]

The composition of these products is shown by the following analyses:

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[1] Conn. Exp. Sta., Bulletin 210, p. 224 (1918).

Number	**13175**	**13970**
Solids	23.19%	24.86%
Ash	1.50	1.59
Protein	6.76	6.89
Sugar	8.79	10.48
Fat	6.14	5.90
Constants of fat:		
Butyro-refractometer at 40°C.	36.8	36.00
Reichert-Meissel No.	9.2	.....

MILK POWDER.

Four samples of milk powders have been examined.

Klim brand, Powdered Whole Milk, **14412**; Klim brand, Powdered Skimmed Milk, **14413**; and Powdered Modified Milk, **15037**, for infant feeding, all made by the Merrell-Soule Co., Syracuse, N. Y.

Powdered Skimmed Milk, **14809**, made by the National Dry Milk Co., Dacoming, Wisconsin.

Products of this class examined by us in previous years have been summarized in an earlier Bulletin[1] from this laboratory.

Analyses of the products examined this year are as follows:

TABLE IX.—ANALYSES OF MILK POWDERS.

	14412	**14413**	**15037**	**14809**
	%	%	%	%
Moisture	3.23	4.00	2.76	5.03
Ash	5.98	8.23	7.15	7.88
Protein (N x 6.38)	24.88	33.55	17.23	33.36
Lactose (by difference)	37.75	53.08	53.52	53.03
Fat	23.16	1.14	19.34	0.70
Acidity (as lactic acid)	....	....	0.85	1.72

In case of the whole milk powder it is directed to take eight special measures to one quart of water to make one quart of whole milk. Provided the powder is so measured as to obtain four and one-half ounces a milk of good quality will be secured. To do this however, the special measure which accompanies the package must be rather closely packed.

The analysis of the modified milk powder is substantially as stated on the label of this product.

MALTED MILK, ETC.

Six samples of products of this class have been examined. The brands include Borden's **13967**; Horlick's **13969**; and two products made by Thompson's Malted Food Co., Waukesha, Wisconsin, viz., Thompson's Malted Milk, **13579, 13968** and Thompson's Hemo, **13580, 14260.** Hemo is stated to consist of the combined extractives of barley and selected wheat, pastuerized milk, beef peptones and hemoglobin.

Analyses of these products are as follows:

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[1] Conn. Exp. Sta., Bulletin 213, p. 406 (1919).

TABLE X.—ANALYSES OF MALTED MILK, ETC.

Number	**13967**	**13969**	**13968**	**13579**	**13580**	**14260**
Moisture	2.55%	3.05%	4.04%	3.72%	2.74%	...
Ash	2.93	3.80	3.80	4.32	4.65	...
Protein	14.38	15.06	10.00	12.75	13.50	...
Fiber	0.45	0.40	0.26	0.12	0.09	...
Nitrogen-free extract	70.71	69.59	74.69	73.59	73.62	...
Fat	8.98	8.10	7.12	5.50	5.40	...
Starch	none	none	none	trace	none	...
Iron (Fe.)	0.0013	0.0020	0.0002	....	0.0013	0.0050

Hemo contained 1.86 per cent. of water-soluble nitrogen distributed as follows: coaguable 0.87, precipitable by tannin-salt 0.83, residual 0.16. Malted milk, **13968**, contained 1.47 per cent. of water-soluble nitrogen distributed as follows: coaguable 0.83, precipitable by tannin-salt 0.49, residual 0.14. In the case of Hemo about 45 per cent. of the water-soluble nitrogen was precipitated by tannin-salt while in malted milk about 33 per cent. was precipitated by the same reagent indicating a larger proportion of nitrogenous substances of the peptone group in Hemo. It is understood, however, that tannin-salt is not a specific reagent for peptones, but precipitates other intermediate digestion products of protein such as proteoses, polypeptides, etc. The comparative figures given above are interesting, but the data is insufficient as a basis for any general conclusion.

Hemoglobin is the coloring matter of blood-corpuscles and is conspicuous for its iron content. The comparative figures for iron in the analyses given above show in one sample of Hemo no more iron than was found in Borden's malted milk; the second sample, **14260**, shows substantially more. Again the figures are suggestive rather than conclusive on account of limited data. According to analyses available in the literature the iron content of milk itself shows wide variations due in part no doubt to analytical differences.

The method we have employed for the determination of iron is as follows:[1]

Standard solution: Dissolve 0.7 gram of crystallized ferrous ammonium sulphate in 50 cc. of distilled water, acidify with 20 cc. of dilute sulphuric acid, heat slightly, add N/10 potassium permanganate until a faint pink color is obtained and dilute to a volume of 1000 cc. One cc. of this solution is equivalent to 0.0001 gm. of Fe. Prepare a series of standards using 1, 2, 3, etc., cc. of this solution to which is added 5 cc. of a solution of potassium thiocyanate (1:50) and dilute to a volume of 50 cc.

Determination: Burn 10 grams of sample in a platinum dish avoiding excessive heat. Add 5 cc. of conc. hydrochloric acid to dissolve the ash, transfer to a 100 cc. flask, add sufficient N/10 potassium permanganate to produce a faint pink color and dilute to volume. Filter if necessary. Take an aliquot of 40 cc. (= 4 gms. original material) add 5 cc. of potassium thiocyanate and dilute to 50 cc. Mix and compare with standards.

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[1] Standard Methods of Water Analysis. Am. Public Health Assoc., 1917, p. 44.

HUMAN MILK.

Fourteen samples of breast milk have been examined chiefly at the request of physicians and of the Visiting Nurse Association of New Haven. The value of these analyses is entirely dependent upon whether or not the samples are representative. All of the milk available at the time of feeding should be drawn and thoroughly mixed before sampling. The variations in composition between so-called 'foremilk', 'middlemilk', and 'strippings' from cows is well known. Söldner[1] has shown what these variations may be in the case of milk drawn from the human milk gland. In the following tabulation, Table XI, the first, second and third portions correspond to the fractions just indicated.

TABLE XI.—COMPOSITION OF DIFFERENT PORTIONS OF HUMAN MILK.

Sample.	Portion.	Weight of portion gms.	Solids. %	Protein (Nx6.38). %	Fat. %	Sugar. %	Ash. %
17	1st	33.1	8.82	1.15	1.71	5.50	0.46
	2nd	33.3	9.75	0.96	2.77	5.70	0.32
	3rd	57.3	10.72	0.83	4.54	5.07	0.28
67	1st	48.3	9.87	0.89	1.94	6.82	0.22
	2nd	30.3	14.11	0.89	3.07	9.92	0.23
	3rd	40.1	11.74	1.08	4.58	5.87	0.21
93	1st	39.6	8.44	1.08	1.23	5.97	0.16
	2nd	37.9	9.66	0.89	2.50	6.03	0.24
	3rd	41.9	12.17	0.89	4.61	6.43	0.24
118	1st	30.0	9.02	1.08	2.54	5.17	0.23
	2nd	22.5	10.42	1.02	3.98	5.17	0.25
	3rd	31.8	13.70	1.08	7.20	5.17	0.25

It is at once evident from these figures that the variations are chiefly due to fluctuations in fat content; and that no adequate idea of the substance and quality of the milk supply can be obtained unless the entire secretion of the gland is drawn and mixed before sampling. Thus the fat content of the entire yield in case of sample 17 is 3.22 per cent.

Analyses of the samples submitted during the past year are given in Table XII.

TABLE XII.—ANALYSES OF HUMAN MILK.

Station No.	Solids %	Protein (N x 6.38). %	Fat. %	Sugar. %	Ash. %
13634	14.10	1.37	5.8	6.73	0.20
14295	10.39	1.24	1.6	7.32	0.23
14296	...	2.23	2.64	....	....
14353	...	...	2.50	....	0.31
14398	12.95	1.72	4.0	7.00	0.23
14632	10.80	1.28	2.0	7.29	0.23
14942	15.59	...	6.9	..	0.19

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[1] Lane-Claypon, Milk and Its Hygienic Relations, p. 23.

TABLE XII.—ANALYSIS OF HUMAN MILK—*Continued.*

Station No.	Solids	Protein (N x 6.38).	Fat.	Sugar.	Ash.
	%	%	%	%	%
14969	13.14	1.28	4.5	7.11	0.25
15105	14.77	1.50	5.3	7.75	0.22
15016	13.34	1.46	3.7	7.94	0.24
15172	...	...	4.0	...	...
15180	...	1.21	6.8	...	...
15221	12.17	1.02	3.8	7.17	0.18
15295	12.20	1.08	3.6	7.31	0.21

SYRUPS.

Two samples of bakers' syrups were examined.

14202. *Syromal.* It was found to contain 50 per cent. of cane sugar and 16.6 per cent. of invert sugar as determined by copper reduction methods. Polarizations at 20°C. were direct +36.3°, invert—10.4°.

14203. *Syrup,* claimed to be made of cane syrup, honey and acetic acid. It contained 42.8 per cent. of cane sugar and 30.2 per cent. of invert sugar. Polarizations at 20°C. were direct ±0°, invert —20.0°.

TEA.

No samples of tea were examined during the past year for inspection purposes, but methods for the determination of caffein were further studied and the results included in the report of the writer as Referee on tea to the Association of Official Agricultural Chemists at their annual meeting in November 1920.

The Power and Chestnut method[1] was studied and recommended to the Association as an official method. The Stahlschmidt method[2] which is now tentative, was further modified[3] so that caffein residues of a high degree of purity can be obtained. A new proceedure was also evolved[4], based upon the two methods just mentioned and the Deker[5] method, which has thus far been found to give satisfactory results and which is rapid and simple to manipulate. The two last named methods are being submitted for collaborative study with a view to the adoption of one or the other as an optional official method.

The proposed new method is as follows:

Preparation of sample: Grind the tea to pass a 1/25 inch sieve.

Assay: To 5 grams of material in a 500 cc graduated flask add 10 grams of heavy magnesium oxide and 200 cc. of distilled water. Boil gently over a low flame for two hours using a small bore glass tube 30 inches long as a condenser. Cool, dilute to volume and filter through a dry paper. Take an aliquot of 300 cc., equivalent to 3 grams of original material in an erlenmeyer flask of 1,000 cc. capacity, add 10 cc. of a 10 per cent. solution of sulphuric acid and evaporate by gentle boiling until the volume is reduced to about 100 cc. Filter into a separatory funnel washing the flask with small portions of 1 per cent. sulphuric acid, and shake out six times with chloroform using 25, 20, 15, 10, 10, 10 cc. portions. Treat the combined extracts with 5cc. of a 1 per cent. solution of potassium hydroxide. When the liquids have completely separated draw off the chloroform layer into a suitable flask or beaker. Wash the alkaline solution in the separatory with two portions of chloroform of 10 cc. each and unite the washings with the main bulk of extract. Evaporate or distill off the chloroform to small bulk, transfer to a tared flask, evaporate to dryness, and further dry in a water oven at 100°C. to constant weight.

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[1] Jour. Am. Chem. Soc., **41,** 1300.

[2] Jour. A. O. A. C. **2,** 3, 332.

[3] By C E. Shepard and the writer.

[4] By R. E. Andrew and the writer.

[5] Chem Zentr **1,** 1, 62, 1903.

If desired, transfer the residue thus obtained to a digestion flask with successive small portions of sulphuric acid and determine nitrogen by the Kjeldahl method, calculating caffein from nitrogen by the factor 3.464.

The results obtained by the several methods are given in Table XIII.

TABLE XIII.—CAFFEIN IN TEA.

	Stahlschmidt Method.		Power and Chestnut Method.		Proposed Method.	
	By weight.	From N.	By weight.	From N.	By weight.	From N.
	%	%	%	%	%	%
Black tea, 4...	2.83	2.81	3.06	2.99	2.98	2.86
	2.89	2.87	3.05	3.03	2.94	2.87
	2.86	2.84	3.05	2.95	2.92	2.82
	....	....	....	....	2.80[1]	2.80[1]
	....	....	....	....	2.84[1]	2.80[1]
Green tea, 5...	1.64	1.63	1.61	1.55	1.70	1.61
	1.65	1.59	1.69	1.60	1.66	1.58
	....	....	....	....	1.77	1.66
	....	....	....	....	1.57[1]	1.52[1]
	....	....	....	....	1.62[1]	1.57[1]
Green tea, 9...	2.09[2]	1.94	2.12	2.01	2.14	2.08
Black tea, 10..	2.71[2]	2.63	2.69	2.67	2.62	2.62
Black tea, 12..	3.10[2]	2.96	3.20	3.12	3.00	2.93
	....	....	....	....	3.15	3.03
	....	....	....	....	3.12	2.99

Satisfactory methods[3] have been worked out for caffein in coffee but we have been interested to try the proposed method on that substance. In two samples tried we have obtained the following results:

Sample No.	Power and Chestnut Method. By weight.	Power and Chestnut Method. From N.	Proposed Method. By weight.	Proposed Method. From N.
	%	%	%	%
15409	1.51	1.47	....	....
	1.49	1.45	1.61	1.49
15410	0.21	0.17	....	....
	0.21	0.18	0.28	0.24

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[1] Results by H. A. Lepper.

[2] Not purified by treatment with potassium hydroxide.

[3] H. A. Lepper, A. O. A. C. Referee on Coffee, Report of 1920.

Sample **15410** was a decaffeinated product. The results suggest that the method is probably applicable also to coffee.

VINEGAR.

One sample of vinegar submitted by the Dairy and Food Commissioner and nine by individuals have been examined for total solids and acidity. Three were found deficient in one or both particulars and seven were passed. The alcohol content of one of the samples was asked for. No alcohol was found as, of course, should be the case in the well made product.

MISCELLANEOUS MATERIALS.

FOODS, ETC.

Five samples of miscellaneous food products collected by the Station agent and 8 submitted by individuals have been examined.

13954. *Ice cream cones,* made by the Repeater Cone Co., Cheshire, Conn., were found to be free from saccharin and preservatives. They contained: moisture 8.14 per cent., ash 1.05 per cent., protein 7.00 per cent., fat 1.02 per cent., nitrogen-free extract and fiber 82.79 per cent.

13977. *Orangeade Paste,* prepared by Emma Curtis, Melrose, Mass., The preparation is stated to contain fruit flavor and artificial color. It was found to contain 79.43 per cent. of solids, 68.70 per cent. of sugar (expressed as invert sugar), natural fruit flavor and a permitted color, Orange I. No preservative was found. This product has been examined once before[1] in this laboratory with substantially the same results.

13942. *Vanilla Paste,* made by Gra-Rock Products Co., Canton, Conn. Contents of one tube stated to be equivalent to 1 pint of liquid extract. No weight was given but the contents (squeezed out) weighed 36.7 grams. When mixed with a pint (473cc.) of water the solution or emulsion contained 0.01 gram of vanillin per 100 cc. equivalent to 0.13 per cent. in the original paste. The paste consists essentially of gum, glycerine and sugar with a small amount of vanillin. Vanilla extract of standard quality contains in 100 cc. the soluble matter from not less than 10 grams of vanilla bean[2]. The amount of vanillin obtained from 10 grams of vanilla bean will depend upon the quality of the bean and may vary from 0.07 to 0.24 gram[3]. However, this paste contained 0.047 gram of vanillin while the least amount that a pint of vanilla extract may be expected to contain is about 0.33 gram. We are advised that the manufacture of this product has been discontinued.

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[1] Conn. Exp Sta. Bull. 219, p. 240 (1919).

[2] Standards of Purity for Food Products, U. S. D. A. Cir. 136, (1919).

[3] Conn. Exp. Sta. Report, 1901, p. 150.

13979. *Cherry Fam-ly-ade,* and **13978,** *Raspberry Fam-ly-ade,* made by the Fruit Valley Corporation, Rochester, N. Y. Each of these preparations was contained in a two-compartment glass vial; one solution consisted of, or contained, the color and sugar and the other (smaller) contained the flavor. The flavoring solution of **13979** contained 1.67 grams of benzaldehyde per 100 cc. while the flavor of **13978** appeared to be citric acid with some natural raspberry.

14391. *Baking Powder,* was found to be of standard quality as regards available carbondioxide, of which it contained 12.89 per cent.

15072 and **15165.** *Cheese,* two samples, contained 36.35 per cent. and 32.38 per cent. of moisture respectively.

15385 and **16168.** *Honey.* The samples were suspected of containing added glucose but no evidence of adulteration was found.

14170. *Orange Marmalade,* was suspected of containing artificial sweetener. No saccharin or glucose was found.

14402. *Pepper* (white), thought to contain a large amount of foreign material, conformed to the standards for white pepper. The sample contained moisture 9.03 per cent., ash 1.24 per cent., nitrogen 2.15 per cent., crude fiber 4.23 per cent., ether extract 7. 75 per cent. and ash insoluble in acid 0.10 per cent.

15170. *Surface Water,* was submitted for examination for an explanation of a scum thought to be oil. Examination showed, in parts per million, solids 320, loss on ignition (organic) 143, and mineral matter 177. Qualitative tests for iron were strong and there was no indication of oil. The fluorescent scum was due probably to organic iron compounds.

WINES, LIQUORS, ETC.

Ninety-one samples of alcoholic beverages have been examined for alcoholic content, or the presence of methyl (wood) alcohol, or both. The samples have been submitted chiefly by physicians, health and police officials and Prohibition Enforcement agents; and a considerable number of them have been examined by the writer as State Chemist.

Among these samples were eight taken from stock seized by Police and Detectives of Hartford in connection with the sale and consumption of "poison whiskey" which resulted in numerous deaths in that city and neighboring cities during the Christmas Holidays of 1919. On the day of the seizures samples were turned over to this laboratory where the nature of the deadly mixture was discovered and reported to the prosecutor. Of the eight samples six contained from 31.7 to 47.7 per cent. of pure methyl (wood) alcohol, one was fusel oil, used to imitate the whiskey flavor and one was genuine whiskey. Prosecutions which resulted developed the following history: A consignment of 1,000 gallons of methyl alcohol shipped from a distillery in Michigan to a firm in London, England to be used for technical purposes and plainly marked, was stolen in Brooklyn, N. Y., while in transit, and distributed by a gang of bootleggers for beverages purposes. Three barrels found their way into this State with the results already stated, and had it not been for the prompt action of the Hartford authorities much greater disaster would have resulted.

This unfortunate affair naturally threw suspicion for a time upon all alcoholic liquors which accounts in part for the unusual number of samples submitted.

OTHER MATERIALS EXAMINED FOR POISONS, ETC.

Fourty-five samples of miscellaneous materials have been submitted by individuals or public officials to be examined for poisons or suspicious substances. In nine of these, examinations revealed or suggested the probable cause of the symptons or results noted.

14503. *Cake* with cocoanut frosting. The cake was suspicious because the cocoanut turned intensely pink after 24 hours. The pink color was extracted from the cocoanut and shown to be a dye, but not identified. A similar color was extracted from the cake itself. The reaction of the cocoanut on the bottom layer which was overlaid with the alkaline cake did not turn pink. It appeared that the cocoanut absorbed from the cake a color which developed a pink shade in presence of an acid.

14851. *Cider Vinegar.* This was reported to have made several persons ill. A large or considerable amount of arsenic was found.

14292. *Viscera of two geese and a duck.* The birds had died suddenly. Qualitative tests indicated considerable amounts of yellow phosphorus.

14394. *Milk and cereal* mixture prepared for feeding an infant. The sample submitted weighed 180 grams and contained 36 grains of carbolic acid. This amount would no doubt have proved fatal if it had been fed. It is recorded that 22 grains proved fatal to an adult.

14900. *Intestinal contents of a pig.* Large quantities of antimony were found.

15241. *Crystalline substance* found in bottle of milk. It proved to be potassium alum.

14452. *Old Fashioned Brown Sugar.* Complaint was made that an insoluble substance formed when milk was used with it in making candy. It was found that the sugar had an acidity requiring 14 cc. of N/10 alkali to neutralize it. When milk containing this sugar was boiled a coagulum formed. Milk containing the neutralized sugar formed no coagulum on heating. Directions were given for neutralizing the sugar with sodium bicarbonate to obviate the difficulty.

D. C. No. **18409.** *Domino Old Fashioned Brown Sugar.* Complaint was made similar to that in case of **14452.** A sample of the "insoluble substance" was submitted which was found to contain a considerable amount (2 per cent.) of nitrogen. Acidity was not determined but the explanation is doubtless the same as that already stated for the previous sample.

14201. D. C. Nos. **16501** and **18402.** *Rainbow, Sugars.* The colors found were amaranth, indigo, carmine and tartrazine, all permitted colors.

15020. *Well Water.* A sediment in the water was shown to be iron rust or scale.

The remainder of the samples require no comment.

II. DRUGS, ETC.

PROPRIETARY REMEDIES.

Five preparations of this class have been examined.

13167. *Bliss Native Herbs*[1]. The Alonzo O. Bliss Medical Company, Washington, D. C. The remedy is stated to be free from opiates, narcotic drugs and mineral poisons. Forty-five cents was paid for a box of 67 tablets.

Examination and analysis show the following composition:

Average weight of tablets 0.34 gram; reaction faintly aicd; taste bitter. Analysis, parts per hundred: moisture 4.16 ash 6.43 (sulphates, trace, calcium, magnesium and phosphates, considerable); nitrogen 1.00; aloes and licorice present; ginger and cassia indicated; capsicum?; alkaloids none.

13171. *Kalpho,* prepared by the Parker Biochemic Company, New York. Nature's nerve tonic for the treatment of nervousness, sleeplessness, brain fag, etc.; a natural nerve food; contains no harmful nor habit-forming drug. Such are statements taken from the advertising literature.

Examination and analysis show the following composition:

Average weight of tab'ets 0.074 gram. Analysis parts per 100: moisture 0.08; ash 0.05 (ca'cium, sulphates and phosphates none or trace); iodides and bromides none; lactose, hydrated 97.7; extractives with ether from acid and from alkaline solutions, 0.12 and 0.03 respectively; extractives with chloroform from acid and from alkaline solutions 0.10 and 0.05 respectively; tests for alkaloids negative.

The tablets consist of milk sugar probably treated with some medicament in homeopathic dilution. We find no harmful drugs, or anything else of apparent potency.

13168. *Caldwell's Syrup Pepsin and Herb Laxative Compound.* The Pepsin Syrup Co., Monticello, Ill. Five fluid ounces cost 55 cents.

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[1] See also Street, Patent and Proprietary Medicines, p. 36.

Examination and analysis show the following composition:

Specific gravity at 15.6 °C. 1.200; alcohol by volume 5.30 per cent. The following constituents are in grams per 100 cc. Solids 52.81; ash 0.46 (calcium and magnesium present, phosphates and sulphates trace); invert sugar 1.54; sucrose 50.03; emodin-like substances present, senna indicated; salicylic acid (or salicylates) present; ether extractives from acid solution 0.216; chloroform extractives from alkaline solution, 0.026. Cloves and cinnamon flavor.

13172. *Cinot,* made by the Cinot Syndicate, Chicago, and extensively advertised as the Wonder Medicine of the Age. $1.20 was paid for a bottle of 8 fluid ounces.

Examination and analysis show the following composition:

Specific gravity at 15.6°C. 1.0553; alcohol by volume 0.20 per cent. Other constituents are in grams per 100 cc. Solids 13.79; ash 1.22 (phosphoric acid 0.04, sulphur trioxide, 0.10. calcium oxide 0.21, magnesium oxide 0.07); invert sugar 3.29; sucrose 4.22; vegetable material other than sugar 5.06; ether extractives from acid solution 0.67; emodin-like substances present, rhubarb indicated; salicylic acid (or salicylates) present; chloroform extractives from alkaline solution 0.024; alkaloids trace? not indentified.

The preparation is an aqueous solution containing about 14 per cent. of solids one-half of which is sugar and the remainder mineral and vegetable matter consisting of, or containing cathartic drugs including rhubarb. Aside from any efficacy the salicylate may have as a rheumatism remedy it also serves the more useful purpose (to the manufacturers) of preserving the liquid in the enforced absence of an appreciable amount of alcohol.

Possibly the secret of the wonderful remedial effects which are said to follow the use of this medicine is to be found in the literature contained in the package where we read in the directions "Drink plenty of water."

13170. *Allenrhu.* Made by the Alle-Rhume Remedy Co., Rochester, N. Y. Indicated for all conditions of rheumatism, etc. Price $1.50 for 16 fluid ounces.

Examination and analysis show the following composition:

Specific gravity at 15.6°C. 1.0848; alcohol none; the following constituents are in grams per 100 cc.: solids 13.93; ash 6.64 (phosphoric acid 1.72, sulphur trioxide 1.84, calcium and magnesium present); ether extractives from acid solution 0.82 (salicylic acid 0.76); chloroform extractives from alkaline solution 0.01; alkaloids trace?; invert sugar 1.90 sucrose 1.00; organic material (non-sugars) 4.39; emodin-like substances none.

The preparation is an aqueous solution of mineral salts, salicylic acid (or salicylates) with sugar and other organic material. The usual laxative vegetable drugs are not indicated.

SOAP.

Fats and oils are essentially combinations of fatty acids and glycerol. When treated with caustic alkali they undergo a definite chemical process (saponification) whereby the acidic portion of the fat or oil combines with alkali, glycerol is liberated and a soap is formed. In broad terms any metallic salt of a fatty acid is a soap; thus lead, zinc, calcium or magnesium soaps are made and have special uses. But the soaps of household use are the alkali-metallic (sodium or potassium) salts of fatty acids, and it is to this class that the term soap is generally restricted.

Taking as an example a common fat, 890 parts of stearin treated with 120 parts of caustic soda yield 918 parts of sodium soap and 92 parts of glycerol. Incidentally this shows an important reason for the war time economy in the use of fats since about one-tenth of the weight thereof is glycerol which is an essential in the manufacture of munitions.

The art of soap making is of ancient origin, but its chemistry is comparatively modern. Pliny describes a product made from goat's tallow and wood ash lye, and the treatment of fats in this manner is not entirely forgotten in the present day.

Both the character of the fat or oil used and the kind of alkali employed will determine the nature and quality of the resulting soap. The solid vegetable or animal fats, or fatty acids therefrom, with sodium produce hard soaps, while fish and vegetable oils with potassium yield soaps of softer variety. But with the same oil or fat the soap formed by the use of sodium is harder than that formed when potassium is the saponifying agent.

The soaps of sodium and potassium are soluble in water, in which particular they differ from the soaps of other metals and to which they owe their practical importance. The soaps of calcium and magnesium are insoluble and advantage is taken of this fact to distinguish hard waters. If a soluble soap becomes insoluble in water from a particular source it indicates the presence of lime or magnesia to which the hardness of water is due.

So-called marine or salt water soaps are sodium soaps of palm nut or cocoanut oils. They are not rendered insoluble by dilute brine solutions and hence a lather can be produced with them in sea water.

The most important property of soap is its detergent or cleansing action to explain which several theories, none entirely conclusive, are offered. Considerable emphasis has been given to the action of free alkali resulting from hydrolysis of the soap in solution. Mechanical affect has been advanced as an explanation based on the readiness with which soap removes mineral oils from metal surfaces. Since mineral oils do not saponify the chemical factor is eliminated in this instance. Probably the complete explanation includes also a consideration of the Brownian movement or pedisis of the lather, the formation of adsorption compounds and the peculiar properties of colloidal solutions, of which soap in a water "solvent" represents a type.

Judgment of the quality of soap depends upon the purpose for which it is intended. Free alkali should be absent in toilet soap but it is permissible, and in limited amount, advantageous in soaps for scouring and manufacturing purposes. As a rule the less extraneous matter a soap contains the better its quality but there are exceptions such, for example, as the addition of starch to soap for use on woolen or silk fabrics. Insoluble earthy matters, unless for abrasive purposes, are regarded as adulterants; but alkali carbonates, silicates and borates are permissible on account of their detergent properties.

The detailed analysis of soap presents numerous difficulties, some of which are pointed out by Low[1] in a discussion of proposed standard methods of soap analysis. The complex nature of even the common types of laundry soap makes it impossible to show their exact chemical composition by the ordinary uniform methods of systematic analysis. We have attempted, however, to gain a general idea of the substance and quality of the soaps examined by determining the more conspicuous constituent groups by methods generally employed. The samples herein reported have been examined in two different years and the methods used in case of the older samples differ in some respects from those used in later examinations. The methods used in 1919 were based upon those outlined in Allen[2], Sadtler[3], Lewkowitsch[4] and the Bureau of Standards[5]. More recent tentative standard methods[6] have been followed in part in case of samples examined in 1920.

METHODS OF ANALYSIS.

Preparation of sample: Reduce one transverse half of the solid cake to thin shavings or, if possible, run the entire cake through a food chopper, mix well and place in a tightly stoppered container.

Water (and volatile): Dissolve 2 grams of the sample in the smallest possible amount of hot 95 per cent. alcohol. Completely absorb the alcoholic solution of soap with recently ignited asbestos contained in a flat bottom dish, the dish and asbestos being first accurately tared, evaporate on a steam bath and finally dry to constant weight at 100°C.

It was found that practically constant weights were obtained after 5 hours drying except in case of soaps containing large or considerable amounts of glycerin. Since many soaps contain appreciable quantities of glycerin and soaps generally, particularly laundry soaps, contain it to some extent, a method of drying in a vacuum over sulphuric acid at room temperature was tried. This alternate proceedure is as follows:

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[1] Jour. Ind. Eng. Chem, 11, 12, 1169. (1919).

[2] Commercial Organic Analysis, 4th Ed., **2**, 422 et seq.

[3] Industrial Organic Chemistry, p. 85.

[4] Chem. Technol. and Analysis of Oils, Fats and Waxes.

[5] U. S. Dept. Commerce, Bureau of Standards, Circ. 62.

[6] Jour. Ind. Eng. Chem. **11**, 8, 785.

Weigh 2 grams of the sample into a shallow dish, provided with a tight fitting cover to prevent absorption of moisture while weighing the dried sample, place in a desiccator over sulphuric acid, exhaust, and allow to stand for 24-hour periods agitating the surface of the acid occasionally by gentle shaking.

The weight was found to be constant at 96 hours and a shorter period was generally sufficient. Comparative losses by these two methods of drying are given in the following tabulation.

Sample No.	Loss on Drying. Water oven at 100°C. %	In vacuum at room temp. %	Remarks.
13182	4.63	4.63	....
13185	9.92	8.23	Glycerin claimed.
13186	5.02	4.76	....
13187	10.16	7.37	Glycerin claimed.
13188	4.55	4.25	....
13189	13.31	8.29	Glycerin claimed.
13190	5.11	3.87	Glycerin?.
13191	11.21	6.70	Glycerin claimed.

The results by the two methods are seen to agree reasonably well unless glycerin is present. Sample **13190** may have contained this constituent. Neither method represents the true water content of the soaps as considerable volatile matter other than water is lost at the higher temperature while water itself in combinations with certain alkali salts (carbonates and silicates) probably remains in either case.

Unsaponified and unsaponifiable matter: Transfer the dry residue, obtained in the determination of water, to an extraction tube and extract with petroleum ether for sixteen hours in a continuous extraction apparatus. Evaporate the solvent and dry the residue at 100°C. This will give *free fatty acids*, if present, *neutral fat*, and *unsaponifiable matter*. Deduct from this figure the per cent. of free fatty acids as determined subsequently by titration.

Free alkali and free acid: Dissolve 2 grams of the sample in hot neutral 95 per cent. alcohol, filter through a Gooch crucible, wash with the solvent and add a few drops of phenolphthalein to the filtrate. If the reaction is alkaline titrate with N/10 acid and express the result as per cent. of sodium hydroxide. If the reaction is acid titrate with N/10 alkali and express as per cent. of oleic acid (1 cc. of N/10 alkali is equivalent to 0.0282 gram oleic acid).

Alkalinity due to carbonates, silicates and borates: Exhaust the residue in the crucible (obtained in the previous determination of free alkali or free acid), by repeated additions of boiling water, transfer to a 100 cc. volumetric flask, cool and make up to volume. Titrate an aliquot with N/10 acid, using methyl orange as an indicator. The result is the alkalinity due to carbonates, silicates, etc., and is expressed in terms of per cent. of sodium oxide, Na_2O.

Material insoluble in alcohol and in water: Wash the residue still remaining in the crucible (from the previous determination), with a little alcohol and ether, dry at 100°C. and weigh.

Fatty (and resin) anhydrides: In our first analyses Method A was used. Since then Method B has been published[1] and this proceedure was followed in case of samples examined in 1920.

(A) Dissolve 2 grams of sample in 50 cc. of hot water in an Erlenmeyer flask, add 20 cc. of N/2 sulphuric acid and heat on the steam bath until the fatty acids form a clear layer on the surface of the solution. Bring the fatty acids up into the neck of the flask with hot water, and allow to cool. Loosen the hardened fatty acids and, without removing them, filter off the acid solution, saving the same for subsequent titration to determine total alkali. Add 50 cc. of hot water to the fatty acids in the flask and heat again until they form a clear layer, finally bring them into the neck of the flask and allow to harden. Mechanically remove the plug of hardened fatty acids to a small tared beaker. Pass the aqueous solution through the same filter previously employed and combine the filtrate with the previous one saved for the determination of total alkali. To the main portion of fatty acids in the tared beaker add any particles which have accumulated on the filter. If any traces adhere to the sides of the original flask, rinse out the dry flask with small portions of petroleum ether and add the washings to the tared beaker. Evaporate off the solvent, dry at 100°C and weigh. Deduct from this weight the total petroleum ether extract (which included free fatty acids, unsaponified fat, and unsaponifiable matter), and obtain the weight of fatty and resin acids combined as soap. The factor 0.97 has been used to convert figures for fatty and resin acids to their anhydrides although for certain oils this may be inaccurate.

Note. In some cases the fatty acids are liquid or semi-liquid at room temperature. In such instances weigh out 2 grams of dry beeswax and add it to the soap solution. The separated fatty acids will become incorporated with the wax and form a cake. Correct the final weight for the weight of the wax added.

(B). Dissolve 5 grams of soap in 100 cc. of water in a weighed 400 cc. Erlenmeyer flask. When completely dissolved add dilute sulphuric acid in slight excess, place a funnel in the neck of the flask and heat on a steam bath at a temperature not above 80°C until the fatty acids form a clear oily layer. Cool and transfer both fatty acids and acid water to a separatory funnel washing out adhering fat from the flask with petroleum ether (B. P. not over 65°C) using about 50 cc. of solvent. Shake out the fatty acids, avoiding too vigorous agitation, and allow the liquids to separate. Draw off the acid solution. Wash the petroleum ether layer in the separatory with three 25 cc. portions of water adding the washings to the acid solution first separated. Extract the acid solution with petroleum ether in 50, 25, and 25 cc. portions, unite the three extracts and wash with water as in case of the original petroleum ether solution. Filter the original petroleum ether solution and the petroleum ether extracts of the acid washings, both of which are now free from water-soluble impurities, through a paper wet with petroleum ether into a tared flask of suitable capacity provided with a stirring rod. Wash the filter free from fatty acids. Add 100 cc. of freshly boiled neutral 95 per cent. alcohol to the filtrate and titrate with N/10 sodium hydroxide to neutrality using phenolphthalein as an indicator. Calculate Na_2O as soap after deducting for free fatty acids in the original soap. Evaporate the neutral petroleum ether-alcohol solution to dryness breaking up any lumps of soap that may form by means of the stirring rod provided for the purpose. Dry to constant weight at a temperature not over 105°C and express the result as *soda soap* (unsaponified and unsaponifiable matters are included and should be deducted if separately determined). Deduct the weight of sodium oxide (Na_2O), already calculated, from the weight of soda soap to obtain the weight of *fatty anhydride*.

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[1] Tentative Standard Methods for the Sampling and Analysis of Commercial Soaps and Soap Products. Jour. Ind. Eng. Chem., 11, 8, 785-88, (1919).

The data on thirty-eight samples of laundry and toilet soaps are summarized in Table XIV.

There are no official specification or standards for soap in this State. Standards formulated by various Government Departments and by private enterprises differ considerably in their requirements but the following specifications relating to laundry and toilet soaps may be quoted from a set of Government regulations:[1]

Laundry Soap, (for use with soft water). Moisture must not exceed 20 per cent.; volatile matter at 105°C. not more than 34 per cent.; free alkali (as NaOH) not more than 0.2 per cent.; alakline salts, as Na_2CO_3, not more than 1.0 per cent.; insoluble in water not more than 0.1 per cent.; rosin not more than 15 per cent.

Laundry Soap (for use with moderately hard water). Moisture must not exceed 20 per cent.; volatile at 105°C., not more than 34 per cent.; free alkali, as NaOH, not more than 0.5 per cent.; alkaline salts, as Na_2CO_3, not more than 6 per cent., nor less than 2.0 per cent.; insoluble in water not more than 0.5 per cent.; rosin not more than 25 per cent.

Milled (*Toilet*) *Soaps*. Volatile matter at 105°C. must not exceed 15 per cent.; free alkali, as NaOH, not more than 0.1 per cent.; alkaline salts, as Na_2CO_3, not more than 0.3 per cent.; insoluble in water nor more than 0.1 per cent.

White Floating Soap. Volatile matter at 105°C. must not exceed 34 per cent.; alkaline salts not more than 0.5 per cent.; otherwise the same as for milled soap.

Elsewhere[2] it is stated that a good grade of laundry soap will contain not less than 60 per cent. of fatty acids and not more than 0.5 per cent. free (caustic) alkali. Toilet soap should be free from caustic alkali, should not contain excess of water and should be free from loading material or filler.

The following *upper limits* for the several constituents of different types of toilet soaps may also be quoted.[3]

	Free alkali NaOH.	Alkali as Na_2CO_3.	Free fatty acids as oleic acid.	Insoluble matter.	Water.	Actual soap.
	%	%	%	%	%	%
Floating Soap	0.25	0.40	0.50	1.0	20.0	80.0
Transparent Soap.	0.10	0.10	0.25	0.3	15.0	75.0
Castile Soap	0.25	0.25	0.50	1.0	10.0	85.0
Milled Soap	0.10	0.30	0.25	1.0	10.0	85.0

It would appear from the foregoing and other data that above 20 per cent. of water in any hard soap is rather excessive; that free alkali should be present in but very small amounts if present at all; that free fatty acids should not greatly exceed 0.5 per cent. although

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[1] Dept. of Commerce, Bureau of Standards, Circ. 62, (1916).

[2] Canada Inland Revenue Dept., Bull. 408, 1918.

[3] No. Dakota Food Dept., Special Bull., IV, 2, (1916).

TABLE XIV.—ANALYSES OF

Station No.	Brand.	Manufacturer.	Weight of Cake.	Cost of Cake.
	Laundry Soaps.		ozs.	cts.
11959	Best	B. T. Babbitt	8.2	7
12552	Bee	Colgate and Co.	9.1	8
11971	Sunny Monday	N. K. Fairbanks Co.	7.4	6
11960	Ozone	Fairchild & Sheldon Co.	7.9	6
11963	Naptha	Fels & Co.	8.6	7
11968	Borax	Kendall	8.8	5
11961	Borax	Kirkham	10.7	6
12551	Lenox	Proctor and Gamble Co.	8.6	8
12550	Star	Proctor and Gamble Co.	9.1	8
11972	White Naptha	Proctor and Gamble Co.	9.1	8
11962	Arrow Borax	Swift & Co.	9.2	7
12554	Pride	Swift & Co.	8.6	7
11970	U. S. Mail	Globe Soap Co.	8.2	6
12548	Welcome Borax		8.9	8
	Toilet Soaps.			
13178	Miona Witch Hazel	Armour and Co.	2.4	5
13177	Venetian Verbena	Armour and Co.	4.6	10
13194	Castile	Cincinnati Soap Co.	2.2	5
13193	Monarch Oatmeal	Cincinnati Soap Co.	2.5	5
13192	Sternes Buttermilk	Cincinnati Soap Co.	2.3	5
13191	Sternes 47 Transparent Glycerine	Cincinnati Soap Co.	2.0	5
13188	Coleo	Colgate and Co.	2.9	10
13182	Palm	Colgate and Co.	3.4	10
13176	Lucerne Rose	Crystal Soap Co.	3.4	10
12555	Pearl	Globe Soap Co.	4.7	6
11969	White Rose	Globe Soap Co.	3.5	5
13206	Oatmeal	Holman Soap Co.	4.6	10
13207	Pure	Holman Soap Co.	6.4	10
13185	Violet Glycerine	Jergen	2.6	10
13180	Glycerine	J. S. Kirk and Co.	3.8	10
13187	Jap Rose, Glycerine	J. S. Kirk and Co.	3.8	10
13189	Harmony Rose, Glycerine	Liggetts & Co.	4.2	15
13181	Rose Bath	Palmolive Co.	2.7	5
15263	Ivory	Proctor and Gamble Co.	4.6	10
13179	Oatmeal	John T. Stanley	1.9	5
13184	Violet Spray Glycerine	Mm. Waltke & Co.	4.3	10
13190	Jersey Cream	J. B. Williams Co.	3.6	15
13186	Florentine Carnation	A. B. Wrisley Co.	2.8	10
12553	Lifebuoy	Lever Bros. Co.	3.9	10

SOAPS.

Station No.	Actual Soap in Cake.	Actual Soap Cost per Ounce.	Loss on Drying.		Fat and Unsaponifiable.	Free Fatty Acids as Oleic Acid.	Alkali, as Na_2O combined as		Fatty and Resin Anhydrides.	Actual Soap.	Insoluble in Alcohol and Water.
			at 100°C.	in vacuum at 20°C.			Carbonate, Silicate, etc.	Soap.			
	ozs.	cts.	%	%	%	%	%	%	%	%	%
11959	5.1	1.4	25.56	....	4.27	0.42	2.30	7.70	54.71	62.41	2.26
12552	5.6	1.4	27.94	....	1.89	none[1]	1.42	8.96	52.56	61.52	0.50
11971	4.5	1.3	14.03	....	1.16	0.28	4.79	6.51	54.96	61.47	3.65
11960	5.7	1.1	20.17	....	2.92	0.28	0.50	8.79	62.87	71.66	0.33
11963	4.8	1.5	22.96	....	3.36	0.23	1.18	8.35	47.31	55.66	9.59
11968	6.1	1.2	22.90	....	1.69	0.23	1.15	8.77	60.30	69.07	1.63
11961	7.1	1.2	25.33	....	2.34	0.57	0.56	8.51	57.80	66.31	0.05
12551	5.2	1.5	23.04	....	6.45	0.14	1.73	8.62	52.26	60.88	2.68
12550	6.5	1.2	19.54	....	2.23	0.71	1.26	9.14	62.61	71.75	1.12
11972	4.7	1.7	17.92	....	0.42	0.28	6.97	5.18	46.97	52.15	0.80
11962	6.9	1.0	19.64	....	3.35	0.28	0.71	9.29	65.51	74.80	1.18
12554	5.6	1.3	20.74	....	4.72	3.63	0.22	9.94	56.63	66.57	5.38
11970	5.1	1.2	18.88	....	1.28	0.28	3.13	8.88	53.77	62.65	4.50
12548	6.3	1.3	16.53	....	1.73	0.85	2.30	7.65	63.10	70.75	1.40
13178	2.2	2.3	....	4.27	....	1.01	0.11	9.98	80.97	90.95	0.80
13177	4.2	2.4	....	4.95	....	0.42	0.06	10.02	81.81	91.83	0.56
13194	1.8	2.8	....	3.76	....	none[2]	0.20	9.45	72.97	82.42	10.80
13193	1.9	2.6	....	5.66	....	none[2]	0.18	9.00	67.80	76.80	14.53
13192	1.9	2.6	....	4.37	....	none[2]	0.17	9.32	74.48	83.80	8.28
13191	1.3	3.9	11.21	6.70	....	0.67	0.06	7.87	56.29	64.16	0.12
13188	2.7	3.7	4.55	4.25	....	0.56	0.10	10.52	83.42	93.94	0.48
13182	3.2	3.1	4.63	4.63	....	none[2]	0.13	10.46	83.43	93.89	0.10
13176	2.1	4.8	....	7.52	....	none[2]	0.72	7.15	54.29	61.44	0.20
12555	3.9	1.5	8.39	....	0.46	0.42	0.47	10.71	72.44	83.15	1.45
11969	3.0	1.7	6.60	....	0.65	0.23	0.16	10.92	73.42	84.34	1.20
13206	4.1	2.4	....	5.51	....	0.45	0.30	10.08	79.70	89.78	1.44
13207	5.5	1.8	....	3.58	....	none[2]	0.07	9.70	77.48	87.18	6.26
13185	1.7	5.9	9.92	8.23	....	2.14	none	7.81	58.62	66.43	0.12
13180	3.5	2.9	....	6.42	....	none[2]	0.10	10.30	80.94	91.24	0.80
13187	2.5	4.0	10.16	7.37	....	none[2]	0.41	7.68	57.68	65.36	0.02
13189	2.7	5.6	13.31	8.29	....	none[2]	0.26	7.68	57.62	65.30	0.08
13181	2.4	2.1	....	5.65	....	none[2]	0.30	10.27	79.27	89.54	0.70
15263	4.1	2.4	....	9.25	....	0.67	0.08	10.58	78.46	89.04	0.50
13179	1.7	2.9	....	5.96	....	none[2]	0.11	10.11	80.19	90.30	4.72
13184	2.6	3.8	....	8.09	....	none[2]	0.44	7.05	52.90	59.95	0.06
13190	3.4	4.4	5.11	3.87	....	none[2]	0.24	10.39	83.07	93.46	0.18
13186	2.6	3.8	5.02	4.76	....	0.45	0.10	10.27	81.43	91.70	1.18
12553	3.3	3.0	10.25	....	1.18	0.56	0.12	8.38	76.63	85.01	0.05

[1] Free alkali trace.

[2] Free alkali none.

many specifications omit any reference to this item from which we might infer that it was not of serious consequence; that alkali combined in forms other than soap and free alkali, i.e., as carbonate, etc., is not undesirable and that the limits vary depending upon the purpose for which the soap is intended; that matter insoluble in water should not exceed about 1 per cent. (much less in toilet soap according to some specifications); and that resin is permissible[1] as a fatty substitute and its soap equally considerable with fatty soap as a detergent.

In interpreting the results summarized in Table XIV, several points should be kept in mind. As already explained loss on drying at 100°C. includes matter which is volatile at that temperature. Drying in vacuum at room temperature approaches more nearly the true water content although alkaline carbonates and silicates will still retain some moisture. Although unsaponified fat and unsaponifiable material have not been determined in all of the toilet soaps the amounts present will be small, generally not exceeding 1.0 per cent. Free alkali is regarded as free caustic alkali, a trace being found in only one sample. Alkali combined as carbonate, silicate, etc., is expressed, in some analyses, as sodium carbonate. We have expressed alkali in these forms as sodium oxide, but the figures can be interpreted as hydrated sodium carbonate by multiplying the figures as given in the table by two. In the case of toilet soaps the fatty and resin anhydrides include fat and unsaponifiable matter which were not separately determined, but the small amount of such material usually present will not substantially alter the figures given. The estimates of cost per ounce of actual soap are based upon the prices actually paid for samples at the time of purchase, but all of the laundry soaps and some of the toilet soaps were purchased in 1919 when the price of soap was abnormally high and somewhat higher than at present, although pre-war prices do not yet prevail.

The analyses indicate that free caustic alkali is not so generally present in soaps as many suppose. The liberation of free alkali by hydrolysis in solution is automatically corrected, to some extent at least, by the presence of free fatty acids which tend to neutralize it as formed. We understand that it is for this purpose that the practice of introducing an excess of fatty material ("superfatting") is adopted.

The losses sustained by the laundry soaps at 100°C. although above 20 per cent. in a number of samples cannot be said to be excessive since the loss is not entirely due to water. The toilet soaps have shown uniformly less than 10 per cent. of moisture.

The limits for free fatty acids judged by the specifications and standards cited are not conspicuously exceeded except in sample **12554.**

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[1] Lewkowitsch, II, p. 1073.

The actual soap, taken as the sum of fatty and resin anhydrides and alkali combined as soap, has been found to be between 60 and 70 per cent. as a rule in the case of laundry soap and generally above 80 per cent. in toilet soaps. Marked deficiencies in this respect in soaps of the latter type are due in part to glycerine and ingredients such as alcohol and sugar which enter into the composition of transparent soaps.

Insoluble matter in the laundry soaps is in most cases much higher than the specifications we have cited. This consists largely, or in part, of insoluble silica. Several of the toilet soaps show high percentages of insoluble matter due perhaps to siliceous matter added to increase detersive properties, or inert material such as starch, talc, etc. The cost of actual soap in products for laundry purposes is seen to vary between one cent and one and one-half cents per ounce, this upper limit being exceeded in only one case. The range is greater in the toilet soaps, the cost varying from one and one-half to about six cents per ounce. It will be noticed that no high-priced fancy soaps are included in the list.

Six miscellaneous samples of soaps have also been examined.

13943. *Cucumber Cream Soap,* made by U. S. Soap Co., New York, was found to contain 16.8 per cent. of water, 22.2 per cent. of fatty anhydrides and 3.4 per cent. of alkali (as Na_2O) combined as soap. It contained 25.6 per cent. of actual soap. Judging from the size of the wrapper the cake, as examined, was only about two-thirds of the original size indicating a large amount of water in the fresh soap.

15137, 15138, 15144. These soaps were examined for the Department of Entomology. They contained in the order named approximately 2.5 per cent., 4.19 per cent. and 35.6 per cent. actual soap.

14221, 14222. *Toilet Soaps.* Samples sent by the Department of Health, Bridgeport. They contained respectively 47.3 per cent. and 46.4 per cent. mineral matter insoluble in water.

TOILET PREPARATIONS.

The following samples were submitted by the Dairy and Food Commissioner.

16863. *Bay Rum.* Made by Wm. H. Loveland Co., Binghampton, N. Y., was declared to contain 20 per cent. of alcohol but was found to contain only 10.48 per cent. No. **16765** was passed. Neither contained wood alcohol.

17130. *Empress Instantaneous Hair Color Restorer,* Dark Brown shade and **17019**, the same name but a black shade. The Empress Manufacturing Co., Inc., New York.

Examination was as follows:

17130, bottle 1, contained paraphenylene diamine; bottle 2 contained 2.28 grams hydrogen dioxide per 100 cc. of solution.

17019, bottle 1, contained paraphenylene diamine and bottle 2 contained 1.16 grams hydrogen dioxide per 100 cc. of solution.

Paraphenylene diamine is a dangerous compound on account of its poisonous properties. Hair dyes, under other names, consisting of the same components as found in this one have been noted before[1].

The manufacturer claims that the danger attending the use of paraphenylene diamine is removed by the use therewith of an oxidizing agent such as hydrogen peroxide. However this may be, the evidence based upon reported injuries following the use of such preparations is that the combination does not work out satisfactorily in practice.

16939. *Liquid Silmerine.* Made by Parker, Belmont & Co., Chicago.

The sample was examined as follows:

Constituents are in grams per 100 cc. Solids 1.91; ash 1.26 (sodium carbonate and borate present); precipitable by alcohol 1.07 (uncorrected for ash).

16938. *Pepsodent.* Made by the Pepsodent Co., Chicago. Only alcohol was determined. It contained 1.52 per cent. alcohol by weight, no methyl alcohol present.

NOTE.

A request for a re-examination of our records in case of samples No. **14842,** Quinol Hair Tonic and No. **14872,** Lily of the Valley Toilet Water was received from the Colgate Company of New York. Examination of these preparations, Bulletin 219 of this Station, pp. 250 and 251, showed them to contain respectively 29.16 per cent. and 67.65 per cent. of alcohol by volume. The manufacturers claimed that careful control of these products was maintained and regularly showed 35 per cent. and 70 per cent. respectively. Our records show that duplicate determinations were made in case of **14842**, because of the variation, and that these were in close agreement; and no error was found in the record of sample **14872.** However, new samples of the preparations named were procured in the market by our Station agent and alcohol determined. Quinol Tonic was found to contain 34.85 per cent., and Lily of the Valley Toilet Water 68.56 per cent. of alcohol.

The Colgate Company was advised of our new results; but we are unable to find our original figures in error.

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[1] Conn. Exp. Sta. Report 1914, p. 289; Report of Chem. Laby., Am. Med. Assoc., 1910, p. 111.

UNITED STATES PHARMACOPOEIA DRUGS.

TINCTURE OF CINCHONA AND TINCTURE OF CINCHONA COMPOUND.

The United State Pharmacopoeia prescribes that Tincture of Cinchona shall contain in 100 mils of solution not less than 0.8 gram nor more than 1.0 gram of alkaloids of Cinchona; and that Tincture of Cinchona Compound shall contain in a similar volume not less than 0.4 gram nor more than 0.5 gram of such alkaloids.

Seven samples of straight tincture and twenty-four of compound have been examined for the Dairy and Food Commissioner. The results are as follows:

TABLE XV.—ASSAYS OF TINCTURE OF CINCHONA AND TINCTURE OF CINCHONA COMPOUND.

D. C. No.	Manufacturer or Dealer.	Alkaloids, gram. per 100 cc.
	Tincture of Cinchona.	
16950	*Bristol:* The Madden Drug Store	0.92
16752	*Danielson:* W. E. LaBelle	0.42
16923	*Hartford:* The Goodwin Drug Store	0.83
16598	*Norwich:* John A. Dunn	0.83
16582	*Putnam:* James F. Donahue	0.95
16862	*Waterbury:* Apothecaries Hall	0.78
16574	*Willimantic:* G. O. Cartier	0.61
	Tincture of Cinchona Compound.	
16851	*Bristol:* The Madden Drug Store	0.41
16703	*East Hartford:* W. B. Noble	0.54
16719	*Glastonbury:* The Peoples Pharmacy	0.36
16922	*Hartford:* The Goodwin Drug Co	0.49
16885	*Meriden:* N. P. Forcier	0.59
16758	*Mystic:* Edw. W. Gaskell	0.29
16771	*New London:* Dr. A. Crocicchia	0.35
16769	L. P. Desmarais	0.28
16762	James Drug Store	0.82
16600	*Norwich:* John A. Dunn	0.67
16593	Pitcher & Service	0.80
16586	*Putnam:* Ed. H. Burt	0.38
16583	James F. Donahue	0.46
15887	*Rockville:* Metcalfs'	0.51
15895	Thomas Pharmacy	0.57
16728	*South Manchester:* J. H. Quinn & Co	0.37
16723	T. Weldon & Co	0.45
16737	*Stafford Springs:* D. H. McCormick	0.37
15879	*Thompsonville:* Wm. J. O'Brien	0.33
16860	*Waterbury:* Apothecaries Hall	0.31
16868	H. W. Lake Drug Co	0.50
16575	*Willimantic:* G. O. Cartier	0.43
16886	*Winsted:* F. B. Bannon	0.42
16891	G. L. Fancher	0.48

In 12 cases the preparations are within the United States Pharmacopoeia limits.

In 7 cases the variations are less than 10 per cent. of the standards; in 12 cases they exceed 10 per cent. Several preparations would be satisfactory if correctly labeled. For example, No. **16752** is low for a straight tincture, but is within the limits for a compound, while Nos. **16593** and **16762** are too high for compounds, but would pass for straight tinctures. As they stand however, they must be classed as adulterated.

SOLUTION OF HYDROGEN DIOXIDE.

The United States Pharmacopoeia requires that this preparation shall contain not less than 3 per cent. by weight of hydrogen dioxide (H_2O_2).

Among other specifications are the following:

Not more than 0.03 gram of solid residue remains on evaporating 20 mils of solution to dryness; and not more than 2 mils of N/10 potassium hydroxide are required to neutralize 25 mils of the solution.

Results of our analyses of twenty-three samples are as follows:

TABLE XVI.—ASSAYS OF HYDROGEN DIOXIDE.

D. C. No.	Brand.	Hydrogen dioxide. %	Solids, gm. per 20 cc.	Acidity, ccN/10KOH per 25 cc. solution.
16595	A. D. S	3.62	0.021	1.80
16877	Albany Chemical Co	3.07	0.024	2.50
16705	Brewer & Co	3.29	0.015	1.88
16754	Brewer & Co	3.04	0.015	2.25
16883	Brewer & Co	3.03	0.057	5.00
16772	Butler Bros	3.02	0.022	1.38
16893	Earle & Co	3.07	0.016	1.65
15885	Eastern Drug Co	3.07	0.026	1.25
16770	Eimer and Amend	3.18	0.024	1.88
16920	Goodwin's Drug Store	3.08	0.018	2.88
16590	Mallinckrodt Chemical Works	2.88	0.037	1.38
15897	Mallinckrodt Chemical Works	3.05	0.024	0.63
16711	Mallinckrodt Chemical Works	3.00	0.033	1.38
16724	Mallinckrodt Chemical Works	3.05	0.023	0.75
16596	Merck & Co	2.95	0.030	1.38
16866	National Peroxide Co	3.15	0.024	1.63
16579	Oakland Chemical Co	3.74	0.008	0.65
16571	Parke, Davis Co.	3.08	0.017	1.85
16716	Parke, Davis Co	3.16	0.024	2.13
16735	Parke, Davis Co.	3.11	0.025	2.25
16852	Parke, Davis Co.	3.20	0.025	1.63
15869	Powers-Wightman-Rosengarten Co	3.09	0.023	1.38
16751	Powers-Wightman-Rosengarten Co	3.01	0.029	2.38

All of the samples meet the requirement as to actual hydrogen dioxide or come within reasonable limits thereof, or of the declared strength; but several show excess of solids or of acidity or both. Since it has been found that the exact manipulation of the Pharmacopoeia method for acidity gives uncertain results in some cases, a modified proceedure[1] has been followed in case of samples showing high acidity.

Samples **16920, 16877, 16751, 16735,** and **16754** are in excess of the Pharmacopoeia specifications for acidity by more than 10 per cent.; **16590** is in excess in solids; and **16883** is greatly in excess both as regards acidity and solids.

LIME WATER.

The United State Pharmacopoeia requires that this solution shall contain not less than 0.14 per cent. of calcium hydroxide when prepared at 25°C.

The percentage of calcium hydroxide varies somewhat with the temperature at which the solution is prepared being about 0.17 per cent. at 15°C. and diminishing as the temperature rises.

Thirty-two samples were examined for the Dairy and Food Commissioner of which twenty-five met the requirements and seven were deficient. The deficient samples ranged from 31.4 per cent. to 81.0 per cent. of standard strength.

The results are as follows:

TABLE XVII.—ASSAYS OF LIME WATER.

D. C. No.	Manufacturer or Dealer.	Calcium hydroxide, per cent.
16942	*Bristol:* Perry N. Holley	0.173
16949	The Madden Drug Store	0.150
16753	*Danielson:* W. E. LaBelle	0.146
16704	*East Hartford:* W. B. Noble	0.101
16712	O'Connell Drug Co	0.159
16717	*Glastonbury:* The People's Pharmacy	0.145
16919	*Hartford:* The Goodwin Drug Co	0.106
16756	*Jewett City:* Charles R. Carey	0.179
16876	*Meriden:* W. W. Mosher	0.178
16881	Charles H. Pinks	0.167
16884	N. P. Forcier	0.054
16937	*Middletown:* John J. Cronin	0.178
16760	*Mystic:* Edward Gaskell	0.190
16853	*New Britain:* Crowell's Drug Store	0.176
16767	*New London:* J. Burro	0.185
16592	*Norwich:* P. F. Bray	0.114
16597	George M. Rathborn	0.179
16585	*Putnam:* James F. Donahue	0.142
16589	E. H. Burt	0.179
15886	*Rockville:* Metcalf's	0.077
15896	Thomas Pharmacy	0.044
16730	*South Manchester:* J. H. Quinn & Co	0.155
16738	*Stafford Springs:* D. H. McCormick	0.169
16743	Ethel H. Wickes	0.170
15872	*Thompsonville:* George R. Steele, Est	0.179
15878	William J. O'Brien	0.165
16858	*Waterbury:* Apothecaries Hall	0.058
16870	H. W. Lake Drug Co	0.169
16572	*Willimantic:* G. O. Cartier	0.163
16577	Charles DeVilliers	0.161
16890	*Winsted:* G. L. Fancher	0.174
16894	John A. Williams	0.165

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[1] Conn. Exp. Sta. Report, 1909, p. 266.

SOLUTION OF MAGNESIUM CITRATE.

One hundred mils of this solution contains magnesium citrate corresponding to not less than 1.5 grams of magnesium oxide.

There is no direct numerical standard for citric acid, but according to the formula as given by the Pharmacopoeia one hundred mils should contain 9.4 grams of this ingredient.

Of the twelve samples examined for the Dairy and Food Commissioner only one failed to meet the required or declared strength as regards magnesium oxide. The following summary shows the results of assays compared with the requirements of the standard or special declarations.

Sample No. **16924** was assumed to be of standard strength, there being no declaration to the contrary, but it was found to be only 60 per cent. of standard. In cases where special declarations of quality or strength were made they were found to be substantially correct. The deficiencies in total citric acid may possibly arise from a part of the magnesium being derived from magnesium sulphate.

TABLE XVIII.—ASSAYS OF SOLUTION OF MAGNESIUM CITRATE.

D. C. No.	Manufacturer or Dealer.	Magnesium oxide, gms. per 100 cc. Required.	Magnesium oxide, gms. per 100 cc. Found.	Free acid, as citric, gms. per 100 cc.	Total citric acid, gms. per 100 cc. Required.	Total citric acid, gms. per 100 cc. Found.
16710	*East Hartford:* O'Connell Drug. Co	1.5	2.11	3.85	9.4	10.40
16924	*Hartford:* The Goodwin Drug Co.	1.5	0.90	1.87	9.4	5.78
16761	*Mystic:* Edward W. Gaskell	1.5	1.71	3.29	9.4	9.94
16857	*New Britain:* Crowell's Drug Store	1.5	1.69	2.91	9.4	9.39
16773	*New London:* Dr. A. Crocicchia	1.5	2.06	1.21	9.4	8.79
16594	*Norwich:* Pitcher & Service	0.9	0.94	1.70	5.6	5.45
16588	*Putnam:* E. H. Burt	1.3	1.26	0.62	5.4	5.37
15888	*Rockville:* Metcalf's	1.5	1.42	2.55	9.4	7.46
16736	*Stafford Springs:* D. H. McCormick	1.5	1.62	2.32	9.4	8.07
15871	*Thompsonville:* George R. Steele, Est	1.5	1.52	4.03	9.4	7.98
16859	*Waterbury:* Apothecaries Hall	0.8	0.87	2.48	...	6.09
16576	*Willimantic:* Charles DeVilliers	0.8	0.77	1.28	...	3.99

TINCTURE OF NUX VOMICA.

The United States Pharmacopoeia requires this preparation to contain not less than 0.237 gm. nor more than 0.263 gm. of the alkaloids of nux vomica.

Twenty-five samples were submitted by the Dairy and Food Commissioner for examination. Only three were found to be within the prescribed limits of 0.237 to 0.263. Ten others, however, varied from these limits by less than 10 per cent. while six more were but slightly in excess of 10 per cent. variation. Of the remaining six samples four were deficient, ranging from 0.160 gm. to 0.182 gm. per 100 cc., one was considerably over strength and one was not reported as there was not sufficient material to check the original assay which showed a deficiency.

The results are as follows:

TABLE XIX.—ASSAYS OF TINCTURE OF NUX VOMICA.

D. C. No.	Manufacturer or Dealer.	Alkaloids of Nux Vomica gm. per 100 cc.
16948	*Bristol:* The Madden Drug Store	0.160
16702	*East Hartford:* W. B. Noble	0.200
16713	O'Connell Drug Co	0.232
16718	*Glastonbury:* The Peoples Pharmacy	0.226
16918	*Hartford:* The Goodwin Drug Co	0.262
16755	*Jewett City:* Charles R. Carey	0.226
16759	*Mystic:* Edward W. Gaskell	0.211
16763	*New London:* J. H. James	0.440
16766	J. Burros	0.298
16768	E. Callahan	0.269
16591	*Norwich:* P. F. Bray	0.182
16599	John A. Dunn	0.204
16581	*Putnam:* J. J. Dupre	0.255
16584	James F. Donahue	0.160
16587	E. H. Burt	0.182
15889	*Rockville:* F. E. Metcalf	0.218
15894	Thomas Pharmacy	0.306
16729	*South Manchester:* J. H. Quinn & Co	0.226
15870	*Thompsonville:* George R. Steele, Est	0.226
16861	*Waterbury:* Apothecaries Hall	0.204
16869	H. W. Lake Drug Co	0.255
16573	*Willimantic:* G. O. Cartier	0.218
16578	Charles DeVilliers	0.226
16895	*Winsted:* John A. Williams	—
16887	F. B. Bannon	0.264

SATURATED SOLUTION OF POTASSIUM IODIDE.

A prescription calling for a saturated solution of potassium iodide was presented by an Inspector of the Dairy and Food Commissioner's office at five different drug stores in four different cities in this state. Solutions ranging from 63.5 per cent. to 99.5 per cent. of saturation were obtained, judging saturation by the solubility of the salt at 20°C. The amount of salt in a saturated solution varies with the temperature at which the solution is made. Thus a solution saturated at 25°C. should contain 59.7 per cent. of the salt; if saturated at 0°C. only 56.0 per cent. would be present. The usual range in temperature of "cold water" used in official formulas is taken to be 15° to 25°[1] and we therefore chose the mean of these, or ordinary room temperature, saturated at which a solution should contain 59.0 per cent. of potassium iodide[2].

The results of the assays are given in Table XX.

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[1] U. S. P. IX, p. XLIX.

[2] Seidell, (1907) p. 252.

TABLE XX.—ASSAYS OF "SATURATED" SOLUTION OF POTASSIUM IODIDE.

D. C. No.	Druggist.	Potassium iodide in solution, per cent.	Degree of saturation, per cent.
15787	*Bridgeport:* Julius Ginsbert	58.74	99.5
18401	*Hartford:* Kaufman's Pharmacy	42.42	71.9
15786	*New Haven:* A. Harowitch	37.45	63.5
15850	*Norwich:* D. T. Salesser	50.91	86.3
15851	Smith Pharmacy	54.93	93.1

These results are surprising when one considers that a saturated solution of the salt is very easy to prepare, and that specific information as to its solubility is given in the Pharmacopoeia. Yet three of the solutions show varying degrees of carelessness in preparation.

HAMAMELIS (WITCH HAZEL) WATER.

Among other specifications in the United States Pharmacopoeia this preparation contains not less than 14 per cent. of alcohol, by volume and should not respond to tests for methyl alcohol.

Eleven samples have been examined for the Dairy and Food Commissioner and determinations of alcohol and tests for methyl (wood) alcohol made. No wood alcohol was found in any case and in only one, No. **15863**, was substantially less than the required or declared amount of alcohol found.

The results are as follows:

TABLE XXI.—INSPECTION OF HAMAMELIS (WITCH HAZEL) WATER.

D. C. No.	Manufacturer or Dealer.	Alcohol by volume per cent.	Methyl alcohol
16757	J. R. Carey, Jewett City	14.04	none.
15863	Childs, New York	7.88	none.
16580	Charles DeVilliers, Willimantic	14.20	none.
15875	E. E. Dickenson, Essex	14.00	none.
15893	E. E. Dickenson, Essex	14.60	none.
16706	E. E. Dickenson, Essex	14.28	none.
16725	E. E. Dickenson, Essex	14.40	none.
16943	E. E. Dickenson, Essex	14.20	none.
16915	Goodwin's Drug Store, Hartford	14.04	none.
16865	Salem Chemical and Supply Co., Salem, Mass	14.36	none.
16739	The Sisson Drug Co., Hartford	14.48	none.

MISCELLANEOUS DRUGS, ETC.

Twenty-four samples of miscellaneous materials have been submitted chiefly by health officials and physicians. Two of these were unofficial samples from the Dairy and Food Commissioner's office.

D. C. No. **17042**. *Furniture Polish.* The preparation was found to be a mixture of cottonseed oil and denatured alcohol in the approximate proportions of 90 parts of oil and 10 parts of alcohol.

D. C. No. **15788.** *Essence of Peppermint.* It contained 82.20 per cent. of alcohol, by volume. No methyl alcohol was detected.

14442 and **14395.** *Turpentine.* Neither sample was found adulterated.

14442. Specific gravity at 15.6°C. 0.8851; color white, yellowish; polymerization residue 0.7 per cent.

14395. Specific gravity at 15.6°C. 0.8774; color white; polymerization residue 0.7 per cent.

14406. *Tablets* submitted by a physician for identification were found to contain morphine.

14457. *Pills* submitted by a physician were found to contain codeine.

14622. *Pills* submitted by a physician were found to contain 46.2 per cent. of sodium bicarbonate and 46.1 per cent. of milk sugar. No other medicament was found.

14631. *Tablets* submitted by a physician. These were hypodermic tablets of morphine sulphate, 1/4 grain, and atropine sulphate 1/150 grain. We were requested to determine the variation in gross weights and in weights of medicament.

Twenty-five tablets examined. Minimum weight 0.0244, maximum 0.0274, average 0.0257 gram.

Two groups of three tablets each assayed. Total alkaloid found (1) 0.0160 and (2) 0.0150 gram as morphine sulphate per tablet or 0.246 and 0.230 grain per tablet as compared with 0.256 grain total alkaloid declared.

The tablets were satisfactory both as regards variation in weight and medicament.

14805. *White tablets* submitted for identification. They were found to be morphine hydrochloride.

15336 and **15337.** *Liniment.* Samples submitted by New Haven County Health Officer.

Examinations: **15336.** Reaction alkaline; solids 13.40 grams per 100 cc.; ash 5.58; arsenic (As.) 2.53; vegetable extractives present, unidentified; alcohol none.

15337. Reaction acid; solids 1.98 grams per 100 cc.; ash 0.45; gallic or gallotannic acids indicated.

The first preparation is a water solution containing a relatively large amount of arsenic as the most conspicuous ingredient. The second sample was also a water solution consisting of, or containing, gallic or gallotannic acids or both.

14697, 14698, 14699. *Unknown Drugs,* submitted by the City Health Department, Bridgeport. Two samples were boric acid and the third was potassium permanganate.

15066. *Medicine,* submitted by the County Health Officer, Bridgeport. The sample was greyish white in color, with a salty taste but not bitter. It was found to consist of 98.3 per cent.

bicarbonate of soda and 1.7 per cent. of material insoluble in dilute acid largely or entirely vegetable material, unidentified, but resembling cardamon.

15104. *Medicine,* with prescription submitted by the County Health Officer of Bridgeport. The prescription proved to be too complicated to detect or determine all of the eight ingredients. So far as we could discover, however, there was no evidence that the preparation was not of the substance and quality demanded.

14287. *Saccharin tablets,* were found to consist of saccharin and milk sugar.

15338. *Hair Dye* said to be Canute Water but not submitted in original container.

The amount of material was only 10cc. but it was found to be an alkaline solution of silver nitrate.

14049, 14681. *Arsenate of Lead.* The first was submitted by Dr. Britton, State and Station Entomologist, the second by Mr. Fay, County Agent for Middlesex County.

Analyses:	14049 %	14681 %
Moisture	0.40	.....
Lead (PbO)	65.72	64.13
Arsenic (As_2O_5)	29.18	32.66

15182. *Hexpo,* Smith's, Insecticide and Fungicide.

Analysis in parts per 100:

Moisture 5.65; silica 0.80; sulphuric acid (SO_3) 20.84; copper (metallic) 16.62; lead (PbO) 17.70; arsenic (As_2O_5) 8.10.

The mixture consists of about two-thirds copper sulphate and one-fourth lead arsenate.

15090. *Lime Sulphur Solution.* The specific gravity at 20°C. of the solution was 1.3073 equivalent to 34.1 Baumé. This is somewhat above the average density (24° to 25°).

13647. *Linseed Oil.* The sample was found to contain lead and mineral oils.

15038. *A Veterinary Preparation* said to be Stark's Reducine was found to consist essentially of a fatty base with iodides and tar.

MOTOR GASOLINE.

Gasoline generally signifies a product of crude petroleum produced by the process of distillation. This is called straight refinery gasoline. Newer types are the so-called casing-head gasoline, produced from natural gas by compression or other processes, and "cracked" or synthetic gasoline produced from heavy oils of the kerosene type by the "cracking" process. Both of these products are important factors in the present motor fuel supply but neither is generally sold as such but in the form of blends.

Gasoline is not a definite chemical substance like water or alcohol but a mixture of hydrocarbon compounds in varying proportions. The most essential characteristic of gasoline is its property of rapid vaporization which is shown and measured by determining the distillation range of the fluid. It should not contain too large a proportion of low boiling constituents, a condition which results in undue loss and danger in handling and in storage. These light fractions are the most expensive constituents in gasoline and it is therefor desirable from the standpoint of economy to include as large a proportion of the heavier and higher boiling constituents as the vaporizing power of the engine will permit. The motor derives its power from the heat of combustion of fuel. This is measured in terms of British thermal units (so-called B.T.U's.) and varies within rather narrow limits for the different varieties of gasoline. For this reason the calorific power is not generally determined in routine tests. Specific gravity alone, expressed in Baumé degrees, and generally referred to as the "test," has no significance, as an index to the substance and quality of gasoline.

Chapter 166 of the Public Acts of 1919 relates to the sale of adulterated or inferior products as gasoline. The term "gasoline" as used in the Act is construed to mean "only gasoline which has not been adulterated and with which there has been made no addition, combination or mixture of any other article after it has passed from the ownership of the manufacturer." No standards or specifications are defined in the Act.

Arrangement was made with the Commissioner of Motor Vehicles to test samples of gasoline in this laboratory, but no official samples have been received. Anticipating such work, a few preliminary tests were made of the common market brands. The apparatus and methods used were as described and recommended in Technical Paper 214, Bureau of Mines; and the specifications for distillation range those adopted by the Committee on Standardization of Petroleum Specifications effective November 25th, 1919.[1]

These specifications are as follows:

(a) Initial boiling point not higher than 60°C. (140°F.); (b) 20 per cent. of sample must distill below 105°C. (221°F.); (c) 50 per cent. must distill below 140°C. (284°F.); (d) 90 per cent. must distill below 190°C. (374°F.); (e) end or dry point must not exceed 225°C. (437°F.); (f) not less than 95 per cent. will be recovered in the receiver from the distillation.

The actual *distillation loss* is the difference between the original volume taken (100cc.) and the sum of the volumes of the distillate and of the residue left in the distillation flask.

Data obtained on 15 samples examined are summarized in Table XXII.

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[1]. Oil and Gas Jour. 18, 26, 62 1919. Chem. Absts., 14, 3, 342 1920.

TABLE XXII.—EXAMINATION OF MOTOR GASOLINE.

No.	Date 1920.	Brand.	Color.	Sp. Grav. degrees Baumé 15.6°C.	Acidity, cc N/10 alkali per 100 cc gasoline.	Distillation range, degrees, Centigrade					
						Initial b.p., first drop.	20% distilled at or below.	50% distilled at or below.	90% distilled at or below.	End point.	Distillation loss, per cent.
Standards or Limits.			**Water white**	....	**none**	**60**	**105**	**140**	**190**	**225**	...
13200	3/17	Atlantic	white	61.0	none	35	89	130	187	223	1.0
13948	8/25	Atlantic	white-yel'sh	60.5	none	41	86	127	184	218	0.3
13195	3/17	....	white	58.4	none	45	96	116	160	192	0.3
13949	8/25	....	white-yel'sh	57.2	none	47	100	135	189	220	0.8
13197	3/17	Goodrich	white	60.7	none	40	91	125	185	220	0.5
13946	8/25	Goodrich	white	59.2	none	47	96	137	189	230	1.0
13199	3/17	Gulf	white	60.0	none	40	87	116	182	223	0.5
13951	8/26	Gulf	white	61.8	none	42	92	122	177	212	0.5
13945	8/25	Gulf	white	60.5	none	44	90	119	181	218	0.4
13950	8/25	Socony	white	57.3	none	39	96	135	189	220	0.1
13198	3/17	Standard	white	59.7	none	42	100	128	180	215	0.5
13196	3/17	Texas	white	57.9	0.1	48	99	130	188	223	0.5
13947	8/25	Texas	white	57.9	none	44	95	131	187	225	0.2
13201	3/17	Tydol	white	59.2	none	44	98	128	177	214	0.5
13959	8/25	Tydol	white	62.3	none	51	93	123	183	211	0.6

We are not prepared to discuss these results in terms of the relative desirability or efficiency of the several brands of gasoline represented. Efficiency of fuel utilization depends upon several or many factors other than the quality of the fuel itself. Practically all the samples meet the specifications and standards we have selected in all respects. No. **13946** is seen to exceed the end temperature by 5 degrees and the distillation residue in case of **13196** was slightly acid. It would appear, however, that of two gasolines with the differences shown between **13200** and **13959**, for example, one might be better adopted to a particular condition or purpose than the other. The first shows a larger proportion of the lighter and low boiling fractions together with about the limit of heavy constituents, while the second contains neither extreme. It would also appear that each product sampled at two different seasons of the year shows a reasonably satisfactory degree of uniformity of composition.

SUMMARY.

Materials.	Sampled by, or at request of			Total.	Adulterated, below standard or otherwise illegal.
	Station Agent.	Dairy and Food Commissioner.	Individuals.		
Foods.					
Carbonated Soft Drinks	9	189	0	198	63
Cereal Products:					
Breakfast foods	2	0	0	2	0
Health foods	0	0	3	3	0
Flour	0	4	4	8	2
Cider	0	2	4	6	0
Cocoa	0	1	3	4	0
Coffee	15	2	1	18	0
Desiccated Foods	8	0	0	8	0
Diabetic Foods	120*	0	7	127	....
Egg and Egg Products	10	0	27	37	0
Fats and Oils:					
Olive oil	0	2	3	5	0
Cooking fats	1	2	0	3	0
Butter	0	22	1	23	4
Oleomargarine	0	5	0	5	0
Nut margarine	2	0	0	2	0
Gelatin, etc	0	8	0	8	3
Ice Cream	0	400	4	404	48
Milk and Milk Products:					
Market milk	0	1,056	102	1,158	329
Cream	0	6	4	10	0
Imitation milk	3	0	0	3	0
Milk powder	4	0	0	4	0
Malted milk	4	0	2	6	0
Human milk	0	0	14	14	0
Syrup	0	0	2	2	0
Tea	7	0	0	7	....
Vinegar	0	1	9	10	3
Miscellaneous Materials:					
Foods, etc	5	0	8	13	....
Liquors	0	10	81	91	6
Other materials	0	7	38	45	....
Total	**190**	**1,717**	**317**	**2,224**	**395**
Drugs.					
Proprietary Remedies	5	0	0	5	....
Soap	38	0	6	44	2
Toilet Preparations	2	6	0	8	3
U. S. P. Drugs:					
Cinchona, Tincture of	0	7	0	7	2
Cinchona Compound, Tincture of	0	24	0	24	10
Hydrogen Dioxide	0	23	0	23	7
Lime Water	0	32	0	32	7
Magnesium Citrate, Solution of	0	12	0	12	1
Nux Vomica, Tincture of	0	25	0	25	11
Potassium Iodide, Saturated Solution	0	5	0	5	3
Witch Hazel Water	0	11	0	11	1
Miscellaneous Drugs, etc	0	2	22	24	....
Gasoline	15	0	0	15	....
Total	**60**	**147**	**28**	**235**	**47**
Total for Foods and Drugs	**250**	**1,864**	**345**	**2,459**	**442**

*Including 107 analyses in Bull. 220 and not included in Summary for 1919, (See Bull. 219, p. 259).

CONNECTICUT

Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 228 **MARCH, 1921**

Connecticut Round Tip Tobacco

A New Type of Wrapper Leaf

By D. F. JONES

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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Press of The Wilson H. Lee Company.

Connecticut Round Tip Tobacco.

A New Type of Wrapper Leaf for Priming; Recommended for Trial Where Havana is Grown.

By D. F. Jones.

Both Havana and Broadleaf tobaccos grown in New England have rather narrow-pointed leaves so that the yield of wrappers from a pound of leaf is relatively small. In an endeavor to obtain a type having a more nearly round leaf which would equal or prove better than the two well-known varieties in quality and surpass them in yield, a new variety of tobacco has been developed by ten years of selection and testing. This variety is called Connecticut Round Tip on account of the broad, full tips of the leaves and is offered to tobacco growers in the belief that it has certain distinct advantages which make it worthy of serious consideration.

In recommending a new type of tobacco for trial it is fully realized that there are many reasons why any variety differing from those commonly grown may be undesirable for the grower, no matter how meritorious it is, because the trade is unfamiliar with it and there is therefore a tendency to discriminate against it. At the same time no one can maintain that the kinds of tobacco now used will always be grown or that it is impossible to obtain new varieties which will be more profitable than those now employed.

Connecticut Round Tip should not be confused with other new varieties offered from time to time, most of which were variable hybrids which had not been fixed and stabilized nor had they been selected so extensively or carefully as this tobacco has been for certain definite qualities. No plants of Connecticut Round Tip were grown outside of our trial grounds previous to 1918. But in the last three years it has been tested in the field of comparison with types now grown and has been shown to have certain valuable qualities which merit attention.

Origin of the Round Tip Tobacco.

The problem was to combine in one variety or type the higher number and the better shape of leaves of Sumatra with the larger size and other desirable qualities of Broadleaf.

The method of doing this had been developed by previous study of inheritance in tobacco.

An artificial cross was first made between Sumatra and Broadleaf. The seed was planted the next year and from the resulting plants seed was saved for the third year's planting, when the selections were begun.

Each plant was carefully studied and noted as to all important characters which could be observed in the fields. From the plants which represented the desired size and shape, seed was saved under bags for the next year's test while all the less desirable plants were dropped out. This process was repeated year after year for ten successive years till finally three selections remained which seemed equally promising. Then these were tested on a larger scale.

In 1916 about one-third of an acre of each was grown, and separately harvested, cured and sorted and the weights and proportions of the different grades were used in making the final choice.

Throughout the work selection has been based largely on the weights and appearances of the cured and sorted leaves.

It is not a "hybrid" as the term is usually understood. A hybrid is a natural or artificial cross of two fairly settled varieties and the individual hybrid plants the second and immediately following years are very variable. Years of very careful selection are required to secure a variety or type with fixed characters.

The Round Tip here described comes from a "hybrid" which has been carefully protected from natural crossing and selected for ten years so that its uniformity to type is fully equal to that of either of the varieties commonly grown in the state.

This new tobacco is largely the result of the work of E. M. East, formerly with this station and now at the Bussey Institute of Harvard University. H. K. Hayes, also formerly connected with this station, and E. G. Beinhart of the U. S. Department of Agriculture, have had a large part in producing Connecticut Round Tip. The writer has continued and completed the work. B. G. Southwick of the Hartford County Farm Bureau has rendered valuable help in securing the co-operation of growers in carrying out field tests of the variety and in interesting dealers in the merits of the leaf. During the first years of development the tobacco selections were grown for the Connecticut Experiment Station by the Windsor Tobacco Corporation at Bloomfield. Later they were grown at the Shaker Farms at Somers. Much credit is due J. B. Stewart and M. M. Smith for their co-operation in this enterprise.

CHARACTERISTIC FEATURES OF ROUND TIP TOBACCO.

The plant is a tall, vigorous grower which flowers and sets seed abundantly in the field. It has a strong root system which enables the plants to stand up in the field better than Havana. The leaves are not as large as Broadleaf but they are more com-

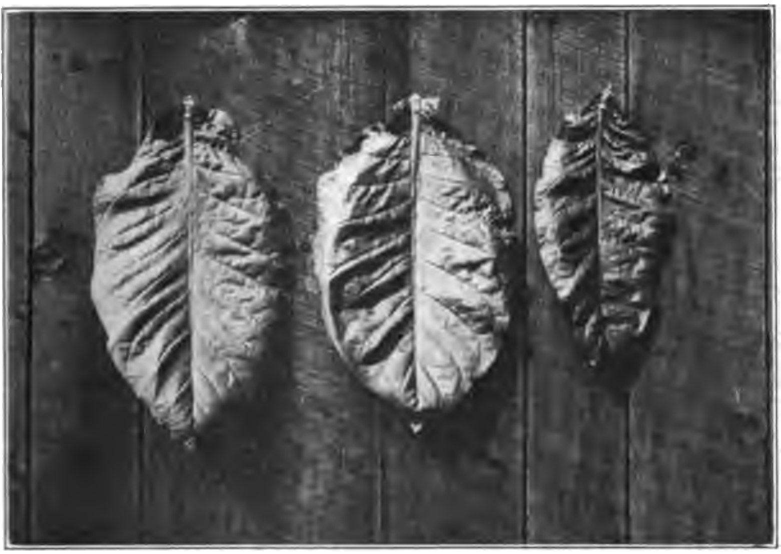

Figure 1. Round Tip leaves from the bottom, middle and top of one plant at the time of first priming.

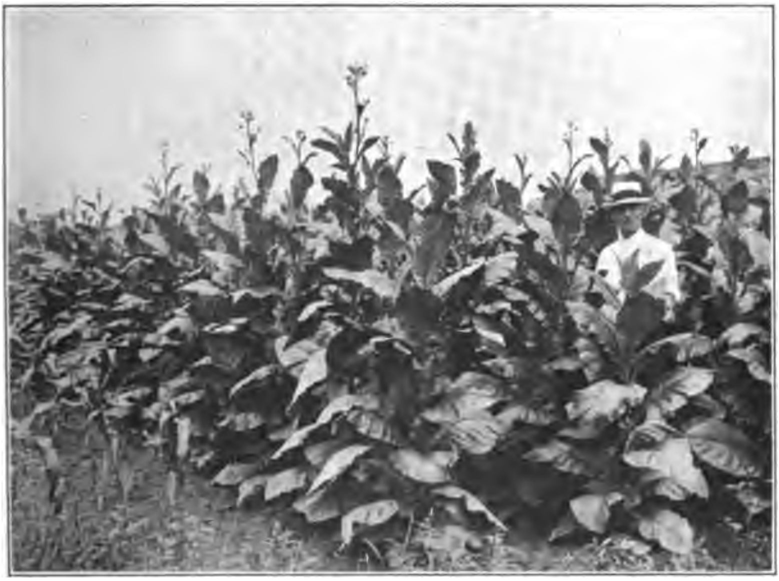

Figure 2. A field of Round Tip grown by Morgan & Dickinson, Windsor, Conn., in 1920, who say: "It showed wonderful growth, averaging 24 leaves to the stalk, and we were particularly impressed with the round shape of the leaves and the plant's root system."

PLATE XVII.

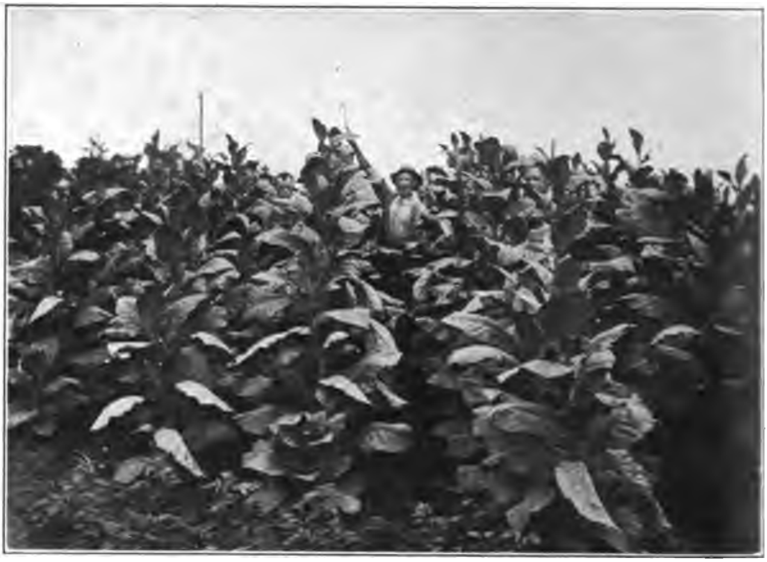

Figure 3. Round Tip plants grown by T. J. Kearney, Poquonock, Conn., in 1920, who was pleased with their vigorous growth and production of numerous and well shaped leaves.

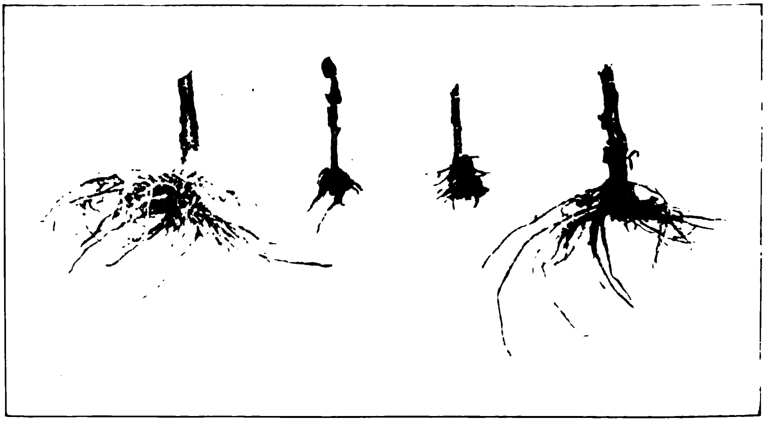

Figure 4. Roots of two plants of Round Tip, at the sides, compared with two roots of Havana, in the center, arranged in the order and comparative distance in which they grew in a field badly infested with root rot.

pact, having a broad rounding shape without the long drooping tip usually shown by that variety. The plants develop from twenty to twenty-four good sized leaves per plant. These are spaced somewhat farther apart on the stalk than those of either Broadleaf or Havana, making the plants more suitable for priming than for stalk cutting. By topping lower with from sixteen to eighteen leaves the cut tobacco can be handled satisfactorily in the sheds.

In one field in 1919 a few plants were accidently set among Havana in the field which was badly infected with root rot. The Havana plants made a very small growth while the Round Tip plants showed no sign of injury to the roots. They were vigorous and fully twice as tall as the Havana plants growing beside them. The differences in root growth are shown in the accompanying illustration. If this resistance to unfavorable soil conditions proves to be characteristic of this variety under all conditions it will be a most valuable feature and one which alone makes the variety very promising.

At their best the leaves are nearly as wide as they are long and are noticeably full at the tip. They are also held upright and close to the stalks, thus avoiding considerable damage in the field. The lengths of the leaves run from sixteen to twenty-six inches but on account of their shape a twenty inch leaf is equivalent to a much longer leaf of either Havana or Broadleaf and pound for pound yields a greater number of wrappers.

In color and quality of cured leaves the tobacco is more nearly like Havana and is recommended for the uses to which Havana is put. Many have said that it resembles shade grown Cuban somewhat. However, in color and general wrapper qualities it is usually distinct from any of the varieties now grown and in time should win a place for itself on its own merits.

Field Tests.

In testing the productiveness and quality of this tobacco it has been difficult to get a satisfactory trial for the reason that it has not been grown in sufficient amount. It has not been posible to devote much seed bed space to the growing plants and consequently there have never been enough plants to set the field all at one time. As a result, plants differing in maturity were harvested at the same time as it was necessary to pick the whole field at each priming. Moreover, the plants were handled as Havana was treated and it has since been learned that the Round Tip requires somewhat different treatment in certain particulars.

It is generally agreed that the leaves should be picked earlier than the Havana leaves of the same stage of development. They should not be left until they show yellow. The plants being large yielders are heavy feeders and must be fertilized accordingly. Producing more leaves than Havana it should be fed proportionately more. This extra expense is fully justified since on a given area and with the same labor, except for handling, a greater quantity of tobacco is produced. The leaves being wider than Havana they should be spaced farther apart in the sheds in order to cure properly.

In 1915 at Bloomfield 1400 pounds per acre were secured and the year following 1800 pounds in three primings not counting tops. In 1918 at the Shaker Farms the rate of 2800 pounds per acre was obtained from a field of about one-third of an acre. In 1919 it was tested in seven different places in the valley by growers of Havana in amounts ranging from one-fourth to five acres. Three of them grew it as a stalk tobacco and the others primed it. The weights ran from 1400 to 1600 pounds per acre. The tobacco was set rather late and on account of uneven planting the conditions were not favorable to this variety.

In 1920 Round Tip was grown in thirteen different places in amounts from a few plants to eight acres. The tobacco made a good growth in spite of a late start in many cases, until damaged by the hail storm. In spite of much injury to the last pickings weights of from 1600 to 2000 pounds per acre were secured. The percentage of light wrappers was also high in nearly every case.

When properly cured the "burn" is satisfactory. The only serious objection to this tobacco is that it may have a bitter taste. Some think that this can be obviated by proper curing and ageing.

Its remarkable ability to stand up on soils in which other tobacco fails to thrive was also shown very clearly in 1920 in those places where a direct comparison could be made.

OPINIONS OF TOBACCO GROWERS.

From M. M. Smith, The Shaker Farms, Somers, Conn.

The young plants of the new variety of tobacco started more quickly, grew a large round tip leaf, required very little suckering, and stood up against a storm better than the ordinary type. As the yield of leaves and weight was more than the type usually grown, believe it should be fed accordingly. Also found that owing to wide spreading of roots, there is danger of too deep cultivation after plant is half matured.

From Morgan & Dickinson, Windsor, Conn.

We set out 9,000 plants of Round Tip on June 27th, 1920, and finished harvesting our tops on Sept. 14th. The 9,000 plants produced 1,778 pounds with some loss in weight by hail, as the last ten leaves were cut in the storm. This tobacco produced 828 pounds of No. 1 Wrappers and 571 pounds of No. 2 Wrappers. It showed wonderful growth, averaging 24 leaves to the stalk, and we were particularly impressed with the round shape of the leaves and the plant's wonderful root system. After assorting and handling this tobacco we bulked same and turned the bulks six times allowing the temperature to reach 116 degrees. After turning the sixth time we baled and placed in a warm room. We have no fault to find with our experiment but on the other hand are very much pleased with it as far as we have gone. We had a local manufacturer use a little of it and the yield is good. He said he could wrap 1,200 cigars with two pounds.

From A. H. Brown, Windsor Tobacco Growers, Inc., Windsor, Conn.

My experience with the Round Tip Tobacco the season of 1919 and 1920, while in the nature of an experiment only so far as the growing and curing is concerned, has convinced me that it possesses many desirable qualities from the grower's standpoint. It seems to produce good results on what is called "sick land" owing perhaps to its stronger root growth, and is less affected by wind storms. The name Round Tip well describes the shape of the leaves and the lower fifteen vary but little in length. In 1919 I harvested from twenty-two to twenty-six leaves per stalk but in 1920 a hail storm destroyed the leaves on the upper part of the stalk after harvesting fifteen but the number was the same as in the previous season. From my experience would advise priming a little earlier than we do the Havana variety at least the lower part of the plant. In regard to the "appearance of the assorted and fermented leaves" the failure of a number of expert tobacco men to select a Sumatra wrapped cigar placed in a box with cigars wrapped with Round Tip is pretty good evidence that it possesses the qualities that the trade demands. While its taste has been adversely criticised many smokers have grave doubts as to their ability to detect it in any way.

From Benjamin L. Haas, L. B. Haas & Co., Hartford, Conn.

Our experience has been that this new type of tobacco requires a greater length of time to cure properly. There are features of this tobacco which necessitate the tobacco being in bulk a greater length of time, and it should lay in the bale, at least, two or three months before being manufactured. There are qualities in the Connecticut Round Tip which must eventually prove to be very profitable to the cigar manufacturers. We are of the opinion that this type of tobacco will become very popular after we understand how to handle it. It requires more time in curing process than any other type of tobacco we are now growing.

From W. A. Haviland, The Haviland Tobacco Co., East Windsor Hill, Conn.

We grew one-half acre of Round Tip on land that had ceased to give us a satisfactory growth of "shade." On one side of this we grew Conn. Havana and on the other a Wisconsin resistant Havana No. 2901. This No. 2901 did very well, in fact much better than the Conn. Havana but the Round Tip throughout the entire season was larger and thriftier than either. Our experience leads us to believe that the Round Tip will yield well, even on "sick soils"; the shape of the leaf is good, the third priming is comparatively better than that of primed Havana and if a certain bitterness can be overcome in sweating Round Tip should be a very valuable tobacco.

From The Farnham Tobacco Corp., Hartford, Conn.

The seed of Round Tip tobacco which I used was rather poor and the general impression I had of the plants was that they were much slower in growing than either the Havana Seed or the Broadleaf. They seemed to be harder to push to the size necessary for planting. I planted the tobacco closely, about eleven thousand plants to the acre, and found the same tendency in regard to growth applied to the early-set plants as well as those which were in the beds, but when the tobacco became eight or ten inches high it grew rapidly and from that time on until maturity it grew faster than any other variety I had. The time for harvesting the first leaves, in my judgment, is when the tobacco reaches the height of a man's shoulder, as I found when picking was delayed it became thick and of very poor color. Just before the tobacco buds out I found it ready to harvest up as high as the fourteenth leaf, and have decided next year to have all the good tobacco off, up to the eighteenth leaf by the time the plants break into flower. I found this tobacco more or less difficult to cure, the leaves having a tendency to stick together, due to the gum which the tobacco carries to a marked degree. The shape of the leaf is all that can be desired both as to length and width. Probably it would suit a larger number of customers if it did not grow as long as it does, but am perfectly satisfied in that regard. The only criticism I have to make is regarding the taste, which of course is a very important one, but I firmly believe that as time goes on it will be taken care of without trouble. The tobacco has a bitter taste, and although extreme temperatures have been tried in the fermentation, it has not been eliminated as yet. I believe that if the tobacco was taken down in very high case and put directly into the bulk and allowed to reach a very high temperature this trouble would be remedied. If this one factor can be taken care of and the tobacco made one which will appeal to the taste of the average smoker, I believe that it is by far the best thing that the Valley has ever had and should really make a new era in tobacco growing.

CONCLUSION.

It has not been our policy to say much about this tobacco as we expect it to win its own way. If it has real merit, as the preliminary trials show, it will be grown in so far as it proves profitable. In order to be appreciated it must be seen growing in the field and after sorting. Before the manufacturers will buy this tobacco they must appreciate what it is and know that it can be secured in quantity. The fact that a large number of cigars can be wrapped per pound of leaves is one forceful reason why they should give this new tobacco a careful trial.

This brief history and description is written to introduce the Connecticut Round Tip to the tobacco growers of this district in the belief that when it is tested on an adequate scale and becomes familiar to the buyer that it will be profitable for growers and manufacturers alike.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 229 MARCH, 1921

BEING THE

Report on Commercial Feeding Stuffs

1920

By E. M. BAILEY

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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March, 1921.

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Press of The Wilson H. Lee Company.

Commercial Feeding Stuffs.

By E. M. Bailey.*

PROVISIONS OF THE STATUTES RELATING TO FEEDING STUFFS.

Under the Connecticut statutes the term "concentrated commercial feeding stuffs" covers practically all feeds excepting hay and straw, whole seed, unmixed meal made directly from any of the cereals or from buckwheat, and feed ground from whole grain and sold directly from manufacturer to consumer.

Under the new fertilizer law cottonseed meal is classed as a commercial fertilizer and, as such, is subject to analysis fees and tonnage tax. Provision is made, however, to exempt meal sold exclusively for feeding purposes.[1]

Section 4775 requires that every lot or parcel of concentrated commercial feeding stuff shall bear a statement giving the name and address of the manufacturer or importer, the number of net pounds in the package, the name of the article, and the percentage of protein and fat contained in it. The law forbids the use of any metal in affixing tags.

No registration of feed or payment of analysis or license fees is required.

The penalty for violation of the statute is not more than $100 fine for the first offense and not more than $200 for each subsequent offense.

The law authorizes this Station to take samples from any manufacturer or dealer, in a prescribed manner, and requires the Station to analyze annually at least one sample of each brand which it has collected, and to publish these analyses "together with such additional information in relation to the character, composition and use thereof as may be of importance."

CLASSIFICATION OF SAMPLES.

The classification and summary of commercial feeding stuffs and other materials requiring fodder analysis which have been examined during the past year is as follows:

---

*Analyses are by Messrs. Shepard, Nolan and Merwin.

[1] Chap. 204, Public Acts, 1919.

Official samples taken by the Station Agent	141
Submitted by the Dairy Commissioner and by individuals	56
Examined in connection with field experiments at Storrs	362
Examined in connection with field experiments of this Station	44
Total	603

This report is concerned only with the results of the official inspection and with samples submitted by the Dairy Commissioner and by individuals.

Official samples taken by the Station Agent are classified as follows:

Cottonseed Meal	16	Maize Products	19
Cottonseed Feed	2	Distillers' Grains	1
Linseed Meal	2	Dried Beet Pulp	3
Wheat Bran	10	Cocoanut Meal	1
Wheat Mixed Feed	5	Peanut Oil Cake	1
Wheat Middlings	16	Proprietary Stock Feeds	53
Rye Products	2	Poultry Feeds	9
Oat Feed	1		
		Total	141

ETHER EXTRACT IN MOLASSES FEEDS.

In 1913 Street[1] called attention to the fact that in case of feeds containing molasses, the regular ether extraction method generally failed to remove all of the ether-soluble substances. By first washing out saccharine materials with water, drying and then extracting with ether higher results for "fat" were usually obtained. Since that time this modified proceedure for the determination of fat has been followed in such samples as were known, or declared, to contain molasses.

A summary of the results for the period 1913 to 1919 inclusive is as follows:

Year	Ether Extract by Modified Method. Higher than regular.	Ether Extract by Modified Method. Lower than regular.	Total number of samples.
1913	17	5	22
1914	7	12	19
1915	18	3	21
1916	11	20	31
1917	6	2	8
1918	0	6	6
1919	11	3	14
Totals	70	51	121

It appears that out of 121 cases, 51, or about 42 per cent., gave lower figures for ether extract by the modified method than by the regular proceedure. Nevertheless it would appear to be a more rational practice to wash out sugars before proceeding to extract with ether and the results, even when lower, are probably nearer the truth so far as true fat is concerned. But since the term fat in a guaranty means crude fat (i. e. ether extract) it has been customary to report the higher figure for this ingredient by whichever method obtained.

---

[1] Conn. Exp Sta. Report 1913, Part V p. 313 et seq.

Of the nine samples of molasses feeds examined this year eight equaled their guaranties for fat by the regular method and they were not subjected to the modified treatment. The one sample falling below guaranty and which was checked by the modified method gave a higher result by that proceedure.

COEFFICIENTS OF DIGESTIBILITY AND NET ENERGY VALUES.

The significance of digestion coefficients and net energy values of feeding stuffs has been briefly discussed in previous bulletins.[1] These factors for most of the types of feeds reported herein are given in the following table:

TABLE I.—COEFFICIENTS OF DIGESTIBILITY AND NET ENERGY VALUES OF FEEDING STUFFS.[2]

Feed	Average dry matter, lbs. per hundred.	Coefficient of digestibility.				Net energy value, Therms per hundred lbs.
		Protein	Fiber.	Carbohydrates.	Fat.	
Cottonseed Meal	92.2	84	37	75	95	90.0
Cottonseed Feed	....	58	45	61	90	....
Linseed Meal (old process)	90.0	89	57	78	89	88.9
Linseed Meal (new process)	90.4	86	73	87	95	85.1
Wheat Bran	89.9	76	43	74	62	53.0
Wheat Feed	....	77	36	76	87	...
Wheat Middlings	89.6	77	30	78	88	59.1
Red Dog Flour	....	88	36	88	86	....
Rye Flour	....	80	..	88	90	...
Barley, ground	90.7	88	70	93	86	89.9
Barley Bran	....	85	20	86	87	....
Corn Gluten Meal	90.9	85	55	90	93	84.2
Corn Gluten Feed	91.3	85	76	88	85	80.7
Hominy Feed	89.9	66	76	90	91	81.3
Brewers' Grains	92.5	81	49	57	89	53.4
Malt Sprouts	92.4	77	87	80	85	72.7
Distillers' Grains, Corn	93.4	73	95	81	95	85.1
Distillers' Grains, Rye	92.8	59	..	67	84	56.0
Beet Pulp, dried	91.8	52	83	83	..	75.9
Peanut Cake, without shells	89.3	90	9	84	90	93.6
Soybean Meal, fat extracted	88.2	92	99	100	68	99.7
Cocoanut Cake	90.4	90	23	87	100	83.5

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[1] Conn. Exp. Sta. Bull. 212 p. 357, 1918; Bull. 221 pp. 347-351, 1919.

[2] Henry and Morrison, 15th ed., pp. 118-119; Armsby and Putney, Penn. Exp. Sta., Bull. 142, 1916.

INSPECTION OF 1920.

REMARKS ON ANALYSES.

(*Analyses on pages* 306-323)

The definitions of the various feeding stuffs here given are those adopted by the Association of Feed Control Officials of the United States and revised to 1920.

Definitions of the several grades of cottonseed meal are as follows:

Cottonseed Meal is a product of the cottonseed only, composed principally of the kernel with such portion of the hull as is necessary in the manufacture of oil, provided that nothing shall be recognized as cottonseed meal that does not conform to the foregoing definition and that does not contain at least 36 per cent. of protein.

Choice Cottonseed Meal must be finely ground, not necessarily bolted, perfectly sound and sweet in odor, yellow, free from excess of lint, and must contain at least 41 per cent. of protein.

Prime Cottonseed Meal must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellow, not brown or reddish, free from excess of lint, and must contain at least 38.6 per cent. of protein.

Good Cottonseed Meal must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, and must contain at least 36 per cent. of protein.

Revision of these definitions is contemplated and tentative definitions[1] are as follows:

41.12 *Per cent. Protein Cottonseed Meal, Choice Quality,* must be finely ground, not necessarily bolted, perfectly sound and sweet in odor, yellow, free from excess of lint, and by analysis must contain at least 41.12 per cent. crude protein, equivalent to 8 per cent. of ammonia.

Cotton seed meal not fulfilling the above requirements as to color, odor, or texture, shall be branded Off Quality.

38.56 *Per cent. Protein Cottonseed Meal, Prime Quality,* must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellow, not brown or reddish, free from excess of lint, and by analysis must contain at least 38.56 per cent. crude protein, equivalent to 7.5 per cent. of ammonia.

Cottonseed meal not fulfilling the above requirements as to color odor or texture, shall be branded Off Quality.

36 *Per cent. Protein Cottonseed Meal, Good Quality,* must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, and by analysis must contain at least 36 per cent. crude protein equivalent to 7 per cent. of ammonia.

Cottonseed meal not fulfilling the above requirements as to color, odor or texture shall be branded Off Quality.

Readjustment of prices is particularly conspicious in this product. The prices given in Table IV were those which prevailed at the time these samples were taken (November and December 1920); the prevailing price at this time (March 1st, 1921) is less than $50 per ton.

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[1] Adopted at the annual meeting of the A. F. C. O., November, 1920.

Of the sixteen samples examined three showed a deficiency in protein of more than 1 per cent. None were deficient in fat. Fiber content is not required to be stated under the law in this State but, if given, it should be correct; three samples exceeded the maximum limit for this ingredient by more than 1 per cent. in each case. The average protein content, 39.4 per cent., is substantially higher than the average found for several years past.

Cottonseed Feed is a mixture of cottonseed meal and cottonseed hulls, containing less than 36 per cent. of protein.

Two samples were analyzed one of which was slightly below guaranty in both protein and fat.

Linseed Meal is the ground product obtained after extraction of part of the oil from ground flaxseed and cleaned of weed seeds and other foreign materials by the most improved commercial processes, provided that the final product shall not contain over six per cent. of weed seeds and other foreign materials and provided further that no portion of the stated six per cent. of weed seeds and other foreign materials shall be deliberately added.

The two samples examined conformed to their guaranties.

Wheat Bran is the coarse outer coating of the wheat kernel as separated from cleaned and scoured wheat in the usual process of commercial milling.

All of the samples examined conformed to their guaranties with respect to protein and fat. One sample, **15652**, showed an excess of fiber.

Wheat Mixed Feed consists of pure wheat bran and the gray or total shorts or flour middlings combined in the proportions obtained in the usual process of commercial millings.

All of the samples examined conformed to their guaranties.

Standard Middlings (*Red Shorts or Brown Shorts*) consists mostly of the fine particles of bran, germ and very little of the fibrous offal obtained from the "tail of the mill." This product must be obtained in the usual commercial process of milling.

Gray Shorts (*Gray Middlings or Total Shorts*) consists of the fine particles of the outer bran, the inner or "bee-wing"bran, the germ, and the offal or fibrous material contained from the "tail of the mill." This product must be obtained in the usual process of commercial milling.

White Shorts or White Middlings consists of a small portion of the fine bran particles and the germ and a large portion of the fibrous offal obtained from the "tail of the mill". This product must be obtained in the usual process of flour milling.

All of the samples examined conformed to their guaranties with the exception of **15640** which was deficient in both protein and fat.

Rye Middlings or Rye Feed consists of the products other than the flour obtained in the manufacture of the ordinary "100 per cent." rye flour from the rye grain which has been cleaned and scoured.

The two samples examined conformed to their guaranties for both protein and fat.

Oat Products. Only one sample of oat feed was analyzed and this satisfied the requirements of the guaranty.

Corn Gluten Feed is that portion of commercial shelled corn after the separation of the larger part of the starch and the germ by the processes employed in the manufacture of cornstarch and glucose. It may or may not contain corn solubles.

All of the samples examined were found to meet their guaranties. In one case, however, no guaranty was given.

Corn Meal. Only one sample was analyzed for which there was no statement of guaranty.

Hominy Feed is the kiln dried mixture of the mill run bran coating, the mill run germ, with or without a partial extraction of the oil and a part of the starchy portion of the white corn kernel obtained in the manufacture of hominy, hominy grits and corn meal by the degerminating process.

The only deficiency found was in **15608** which was 0.95 per cent. below guaranty in fat.

Distillers' Products. Only one sample of distillers' dried grains was examined. It was of normal composition and quality.

Dried Beet Pulp is the material obtained by drying the residue from sugar beets which have been cleaned and freed from crowns, leaves and sand and which have been extracted in the process of manufacturing sugar.

The three samples examined conformed to their guaranties for protein and fat and no excess of fiber greater than 1 per cent. was found.

Cocoanut Oil Meal (*"Copra Oil Meal"*) is the ground residue from the extraction of part of the oil from the dried meat of the cocoanut.

The single sample examined contained 0.94 per cent. less than the guaranteed amount of protein.

Peanut Oil Meal is the ground residue after the extraction of part of the oil from peanut kernels.

The single sample examined was deficient in protein by 2.06 per cent.

Proprietary Mixed Feeds. When compounded with materials of good quality these feeds possess undoubted merit. The variety of sources from which they derive their nutrients makes possible a supplementing of nutritive elements which modern ideas of efficient feeding endorse as a rational practice. They should not be made an outlet, however, for refuse or low-grade materials of little worth.

The law in this State does not require a statement of the ingredients of which such feeds are composed but information is valuable to the feeder and it is furnished in case of the following brands:

Acorn Dairy Feed. Cottonseed meal, linseed meal, wheat bran with mill run screenings, corn gluten feed, ivory nut meal, cocoanut meal, corn feed meal, starch mill corn solubles with calcium salts, salt, kafir meal.

Algrane Milk Feed. Cotton seed meal, linseed oil meal, corn gluten feed, ground corn, wheat midds (with mill run screenings) ground barley, molasses, salt ½ of 1 per cent., oat hulls, oat shorts, oat clippings not over 600 lbs. per ton.

Biles Ready Dairy Ration. Corn distillers' dried grains, choice cottonseed meal, old process linseed meal, white wheat middlings, winter wheat bran, hominy meal, cocoanut oil meal, corn gluten feed, brewers' dried grains, barley malt sprouts, one-half per cent. fine table salt, and nothing else.

Bull Brand Stock Feed. Hominy feed, corn feed meal, barley feed, linseed oil meal, wheat bran, wheat middlings, second clear flour clipped oat by-product and three-fourths of one per cent. salt (wheat bran and wheat middlings may contain ground screenings not exceeding mill run).

Crosby's Stock Food. Ground barley, ground hominy feed, ground oats, oat feed (oat hulls, oat shorts, oat middlings).

Fourex Dairy Ration. Cottonseed meal, old process linseed meal, hominy meal, wheat bran and middlings, gluten feed, reground oat feed (oat hulls, oat shorts, oat middlings). Rye middlings, malt sprouts and salt.

Hamlin's Quality Feed. Corn, oats, alfalfa and cane syrup.

National Dairy Feed. Ground corn, ground oats, wheat bran, screenings from bran, oats, wheat and barley, cottonseed meal, copra meal, alfalfa meal, molasses, one per cent. salt.

Portage Stock Feed. Either white or yellow shelled corn, barley, oat shorts, oat hulls, oat middlings, wheat middlings, and ½ of one per cent. salt.

Purina Cow Chow. Linseed oil meal (old process), gluten feed from corn, hominy feed, cottonseed meal, ground alfalfa, molasses and one per cent. salt.

Purina Pig Chow. Hominy feed, cane molasses, gluten feed from corn, corn meal, digester tankage, linseed oil meal (old process), alfalfa, charcoal (made from humus) and one per cent. salt.

Red Star Dairy Feed. Gluten feed, wheat bran, wheat middlings, old process oil meal, ground barley, cottonseed meal, corn distillers' grains, hominy and 1% salt.

Syragold Milk Ration. Dried brewers' grains, malt sprouts, corn gluten feed, linseed meal, wheat bran with mill run screenings, cottonseed meal, ground cottonseed hulls and salt.

Ti-O-Ga Dairy Feed. Cottonseed meal, old process linseed meal, wheat bran, cane molasses, wheat middlings, cocoanut oil meal, dried brewers' grains, corn gluten meal, corn gluten feed, barley, salt.

H-O Company's Laying Mash. Linseed oil meal, corn gluten feed, bone meal, ground corn, oat middlings, wheat middlings and wheat bran (with mill run screenings), hominy feed, rolled oats, ground peas.

SUMMARY OF DEFICIENCIES.

Variations from guaranty greater than 1 per cent. in protein and crude fiber and 0.25 per cent. in fat together with other remarks or criticisms are summarized in Table II.

TABLE II.—FEEDS NOT CONFORMING TO GUARANTIES OR OTHERWISE ILLEGAL.

Station No.	Brand and Manufacturer.	Protein deficiency.	Fat deficiency.	Fiber excess.	Remarks.
	Cottonseed Meal.				
15601	Crown. Ashcraft-Wilkinson Co., Atlanta, Ga.	% 1.37	%	% 1.21	
15606	Paramount. Ashcraft-Wilkinson Co., Atlanta, Ga.	....	....	....	Wire tags, illegal
15635	Jay. F. W. Brode & Co., Memphis, Tenn.	....	....	....	Wire tags, illegal
15628	Prime. Cotton Seed Products Co., Louisville, Ky.	....	....	....	Wire tags, illegal.
15564	Good. W. D. Hall Co., Atlanta, Ga.	....	....	....	Wire tags, illegal.
15548	Memphis. L. B. Lovitt & Co., Memphis, Tenn.	....	....	1.12	Wire tags, illegal.
15540	Danish. Humphreys-Godwin Co., Memphis, Tenn.	1.44	....	....	
15631	Thirty Six. L. B. Lovitt & Co., Memphis, Tenn.	....	....	....	Wire tags, illegal.
15532	Holstein. Steele-Kolb By-Products Co., Inc., Birmingham, Ala.	2.50	....	3.20	
	Cottonseed Feed.				
15523	77. Humphreys-Godwin Co., Memphis, Tenn.	....	0.37	....	Wire tags, illegal.
	Wheat Bran.				
15620	The Anthony Mills, Anthony, Kansas.	....	....	....	Wire tags, illegal.
15652	The Hunter Milling Co., Wellington, Kansas.	....	....	....	Wire tags, illegal.
15522	Maple Leaf Milling Co., Limited, Toronto, Canada.	....	....	....	Wire tags, illegal.
	Wheat Middlings.				
15640	Shorts. James Goldie Co., Guelph, Ont.	1.25	1.38	..	
	Corn Gluten Feed.				
15561	Hubinger Bros. Co., Keokuk, Iowa‡.	....	....	....	No guaranty.
	Corn Meal.				
15664	Unknown.	....	....	....	No guaranty.
	Hominy Feed.				
15559	Aunt Jemima Mills Co., St. Joseph, Mo.	....	....	....	Wire tags, illegal.
15570	The Patent Cereal Co., Geneva, N. Y.	....	....	....	Wire tags, illegal.
15608	Plymouth's Pure. Plymouth Milling Co., Lemars, Iowa.	0.95	....	....	
	Peanut Oil Meal.				
15657	Beta. Oil Seeds Co., Bayonne, N. J.	2.06	....	....	
	Proprietary Feeds.				
15653	Stock Feed. Hales & Edwards, Chicago‡.	....	0.83	....	
15531	Vitality Stock Feed. Rosenbaum Bros., Chicago.	1.69	....	....	

‡Statement of dealer.

TABLE II.—Feeds not Conforming to Guaranties or Otherwise Illegal—*Concluded.*

Station No.	Brand and Manufacturer.	Protein deficiency.	Fat deficiency.	Fiber excess.	Remarks.
		%	%	%	
15553	Acorn Dairy Feed. Chapin & Co., Hammond, Ind.	....	....	....	Wire tags, illegal.
15629	Crosby's Quality Feed Dairy Ration. E. Crosby & Co., Brattleboro, Vt.	1.12	....	....	
15599	Eshelman's 20 Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa.	2.44	....	....	
15546	Syragold Milk Ration. Syracuse Milling Co., Syracuse, N. Y.	....	....	2.74	
15667	Unknown	....	....	....	No guaranty.
15656	Pioneer Hog Feed. Hales & Edwards, Chicago	....	0.68	....	

MISCELLANEOUS SAMPLES, ETC.

Carob Beans.

Three analyses of carob beans, otherwise known as locust beans and St. John's bread are here given. Sample **15974** was obtained through the courtesy of Meech & Stoddard, Inc., Middletown, who also submitted a sample of bean and pod meal, No. **15833.** The third analysis is taken from the literature[1]. Analyses are of the bean and pod.

Analyses of Carob Beans.

Sample No.	15974	15833	Quoted analysis.
	%	%	%
Moisture	13.29	6.09	15.00
Ash	2.57	16.97	2.50
Protein	4.67	5.19	5.90
Fiber	5.91	6.67	75.30
Nitrogen-free Extract	73.12	62.76	
Fat	0.44	2.32	1.30

The high ash content in **15833** is due to a large amount (12.72 per cent.) of sand from dirt adhering to the beans.

Crude Fiber.

A sample of feed sent out by Mr. G. L. Bidwell, of the Bureau of Chemistry, Washington, Referee on methods for crude fiber determination, was examined in this laboratory by Mr. Shepard. His result, by the method proposed, was 13.35 per cent. By the proceedure employed here he obtained 13.07 per cent.

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[1] Farmer's Bulletin 121, p. 17, 1900.

SAMPLES SUBMITTED BY THE DAIRY COMMISSIONER.

Three samples have been examined.

18528. *Chick feed,* was found to consist largely of cracked corn, oats, rye, millet and screenings. No decomposed or injurious material was detected.

17501 R and **11376 J.** *Interstate samples of Cottonseed meal* by Inspector W. J. Warner to check a sample, **13864,** drawn by our Station Agent. They contained respectively, 5.77 per cent. and 5.82 per cent. of nitrogen. Our original sample, **13864,** contained about 1 per cent. less nitrogen, five determinations on two separate sub-samples giving results of 4.92, 4.84, 4.91, 4.78 and 4.78 per cent. The various samples were taken from what was said to be the same shipment but there were evidently two different grades of meal in the lot. The goods were sold under a guarty of 5.76 per cent. nitrogen, equivalent to 36 per cent. protein.

SAMPLES SUBMITTED BY INDIVIDUALS.

Corn Products. **14404.** Sweet corn, sent by F. C. Hubbard, Middletown, contained 10.4 per cent. of moisture.

14472. Farmers' Gluten, sent by The Coles Co., Middletown, contained 30.63 per cent. of protein.

15813. Gluten Feed, sent by A. S. Tanner, New Preston, contained 24.88 per cent. of protein.

14426. Gluten Feed, sent by H. R. Stone, Southbury, was analyzed as follows:

Moisture 6.30; ash 2.79; protein 25.19; fiber 6.52; nitrogen free extract 55.84; fat 3.36. per cent.

14889. Hominy, sent by Middlefield Grain and Coal Co., Middlefield, contained 11.13 per cent. of protein.

14430. Hominy, sent by Powder Hill Dairy Farm, Wallingford, contained 11.75 per cent. of protein.

14428. Hominy, sent by A. Gerosia, Plainfield, contained 8.85 per cent. of crude fat.

16194. Hominy Feed, sent by the Yantic Grain and Products Co., Norwich, contained 10.50 per cent. of protein and 4.15 per cent. of fiber.

Wheat Products. **15840.** Flour Middlings, sent by M. Asher, Andover, contained 17 per cent. of protein.

14755. Treated Bran, sent by Meech & Stoddard, Inc., Middletown. It consisted of coarse bran, probably wheat, with a small proportion of charred material, evidently the result of toasting or scorching.

15354. Shredded Wheat Waste for poultry, sent by Z. N. Beach, Wallingford, contained 12 per cent. of protein.

Proprietary Mixed Feeds. Fifteen samples have been submitted.

16077. Horse Feed, sent by L. A. Bevan, County Agent, Danbury.

15459. Cow Feed, sent by Miss A. P. Bingham, Rockfall.

15972. Dairy Feed; and **15973.** Dry Mash, both sent by L. B. Merriman, Torrington.

15978 and **15979.** Special Mixtures, sent by L. H. Healey, North Woodstock.

16115. Horse Feed, sent by American Summatra Tobacco Co., East Hartford.

15329. College Stock Feed, sent by H. R. Stone, Southbury. Guaranty, protein 10 per cent.; fiber 11 per cent.; fat 2.5 per cent.; carbohydrates 60 per cent.

15447. Rabbit Mule Feed; **15448.** Green Cross Mule Feed; and **15932.** Monogram Feed, all sent by the Griffin Tobacco Co., Bloomfield.

15411. Big Repeater Dairy Ration, sent by E. H. Rollins, Granby.

15255. Farmer Jones Dairy Feed, sent by Washington Supply Co., Inc., Washington Depot.

14414. Eshelman's 24, sent by L. W. Smith, New Preston.

16054. Dairy Feed, sent by Charles T. Mason, Washington Depot.

The analyses of these feeds are given in the following Table:

TABLE III.—ANALYSES OF PROPRIETARY FEEDS SUBMITTED BY INDIVIDUALS.

Station No.	Moisture. %	Ash. %	Protein. %	Fiber. %	Nitrogen-free Extract. %	Fat. %
16077	6.16	8.79	20.38	6.16	52.97	5.54
15459	10.22	5.85	25.00	8.03	45.69	5.21
15972	7.87	4.21	19.19	9.55	53.61	5.57
15973	7.77	9.10	20.88	7.09	47.98	7.18
15978	7.17	3.86	20.44	8.50	55.05	4.98
15979	7.19	3.95	20.94	7.84	55.99	4.09
16115	7.29	6.97	11.25	13.82	58.59	2.08
15329	10.59	....	13.19	6.99	.....	5.75
15447	8.60	7.32	10.63	14.84	56.83	1.78
15448	8.78	5.05	11.06	11.14	60.82	3.15
15932	6.77	7.21	12.94	10.76	59.88	2.44
15411	10.19	....	24.50	9.96	.....	5.44
15255	.....	....	22.44	.....	.....	....
14414	.....	....	24.88	.....	.....	....
16054	8.28	....	25.44	.....	.....	9.21

Unclassified. **15880.** Alfalfa Feed, damaged, sent by Arthur Mather, Hartford, was found to contain a normal amount (10.13 per cent.) of protein and otherwise not obviously inferior.

15812. Cottonseed Feed, sent by A. S. Tanner, New Preston, contained 35.13 per cent. of protein.

16124. Sample sent by C. E. Slauson Co., Stamford, for identification. The material had the composition and general appearance of dried beet pulp.

14352 and **14336.** Yeast Grains, sent by T. C. Dyer, Collinsville, contained respectively 23.52 per cent. and 21.06 per cent. of nitrogen.

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	OIL SEED PRODUCTS.	
	Cottonseed Meal.	
15601	Crown. Ashcraft-Wilkinson Co., Atlanta, Ga.	*Torrington:* D. L. Talcott
		Guaranty
15584	Helmet. Ashcraft-Wilkinson Co., Atlanta, Ga.	*New Milford:* Geo. E. Ackley
		Guaranty
15606†	Paramount. Ashcraft-Wilkinson Co., Atlanta, Ga	*Winsted:* E. Manchester & Sons
		Guaranty
15635†	Jay. F. W. Brode & Co., Memphis, Tenn.	*South Coventry:* W. C. Latimer
		Guaranty
15628†	Prime. The Cotton Seed Products Co., Louisville, Ky	*Granby:* E. H. Rollins
		Guaranty
15580	Ordinary. Ennis Cotton Oil & Manufacturing Co., Ennis, Tex	*New Milford:* Geo. T. Soule
		Guaranty
15581	Choice. Fidelity Products Co., Houston, Texas	*New Milford:* Geo. T. Soule
		Guaranty
15564†	Good. W. D. Hall Company, Atlanta, Ga.	*Wallingford:* A. E. Hall
		Guaranty
15586	Bull. Humphreys-Godwin Co., Memphis, Tenn	*Danbury:* H. E. Meeker
		Guaranty
15540	Danish. Humphreys-Godwin Co., Memphis, Tenn	*West Chesire:* G. W. Thorpe
		Guaranty
15666	Danish. Humphreys-Godwin Co., Memphis, Tenn	*New Haven:* R. G. Davis & Sons
		Guaranty
15548†	Memphis. L. B. Lovitt & Co., Memphis, Tenn	*Plainville:* Eaton Bros
		Guaranty
15631†	Thirty Six. L. B. Lovitt & Co., Memphis, Tenn	*Hartford:* Meech Grain Co.
		Guaranty
15532	Holstein. Steele-Kolb By-Products Co., Inc., Birmingham, Ala	*Hamden:* I. W. Beers
		Guaranty
15654	Planet. A. C. Westervelt & Co., Memphis, Tenn	*Middletown:* Meech & Stoddard, Inc.
		Guaranty
15598	Winder Oil Mill Co., Winder, Ga	*Waterbury:* Spencer Grain Co
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Cottonseed Feed.	
15555	Danish. Humphreys-Godwin Co., Memphis, Tenn	*Branford:* S. V. Osborn
		Guaranty
15523†	77. Humphreys-Godwin Co., Memphis, Tenn	*East Haven:* F. A. Forbes
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible

†Wire tags.

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Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
15601	6.66	6.50	37.25	11.21	31.51	6.87	$70.00
.....	.....	.....	38.62	10.00	23.00	6.00	.....
15584	6.54	7.53	40.38	7.35	29.24	8.96	60.00
.....	.....	.....	41.00	10.00	23.00	6.00	.....
15606	6.82	6.07	36.19	11.62	32.28	7.02	65.00
.....	.....	.....	36.00	14.00	27.00	5.50	....
15635	7.71	5.03	35.44	13.86	31.57	6.39	58.00
.....	.....	.....	36.00	14.00	30.00	5.00	....
15628	8.98	6.02	39.69	10.36	28.21	6.74	52.00
.....	.....	.....	38.62	10.00	.. ..	6.00	.....
15580	6.80	6.63	46.88	4.77	24.39	10.53	60.00
.....	.....	.....	43.00	12.00	25.00	6.00	.....
15581	6.74	6.73	46.50	4.35	24.62	11.06	60.00
.....	.....	.....	43.00	12.00	.....	6.00	.....
15564	8.11	6.36	36.00	11.83	31.84	5.86	47.00
.....	.....	.....	36.00	14.00	27.00	5.50	.....
15586	6.97	5.83	44.13	7.17	28.16	7.74	62.00
.....	.....	.....	43.00	10.00	26.00	5.00	. ..
15540	7.92	5.92	34.56	12.88	31.95	6.77	58.00
.....	.....	.....	36.00	15.00	25.00	5.00	.....
15666	8.42	6.26	36.50	11.78	29.98	7.06	.....
.....	.....	.....	36.00	15.00	25.00	5.00	.....
15548	8.65	6.45	38.06	13.12	27.21	6.51	70.00
.....	.....	.....	38.50	12.00	27.50	5.50	.....
15631	7.26	6.69	39.38	10.92	27.56	8.19	67.00
.....	.....	.....	36.00	14.00	28.50	5.00	.....
15532	7.62	5.88	33.50	17.20	29.01	6.79	64.00
.....	.....	.....	36.00	14.00	27.00	5.00	.....
15654	11.21	7.32	44.31	6.64	22.24	8.28	62.00
.....	.....	....	43.00	10.00	26.00	6.00	.....
15598	6.27	6.99	41.75	6.81	28.28	9.90	58.00
.....	.....	.....	38.50	7.10	30.75	7.50	.....
.....	.....	.....	**38.70**	**12.07**	**26.48**	**5.62**	.....
.....	**7.67**	**6.39**	**39.41**	**10.12**	**28.62**	**7.70**	**60.86**
.....	.....	.....	**33.10**	**3.74**	**21.47**	**7.40**	.....
15555	8.28	6.35	36.06	11.24	30.56	7.51	64.00
.....	.....	.....	36.00	15.00	25.00	5.00	.....
15523	8.58	3.79	19.63	26.53	37.84	3.63	55.00
.....	.....	.....	20.00	28.00	35.00	4.00	.....
.....	.....	.....	**28.00**	**21.50**	**32.50**	**4.50**	.....
... .	**8.43**	**5.07**	**27.85**	**18.88**	**34.20**	**5.57**	**59.50**
.....	.....	.....	**16.15**	**8.50**	**20.86**	**5.01**	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	OIL SEED PRODUCTS—*Concluded.*	
	Linseed Meal, Old Process.	
15524	Kellogg's Oil Meal. Spencer Kellogg & Sons, Undercliff, N. J	*East Haven:* F. A. Forbes
		Guaranty
15575	Ground Linseed Cake. Midland Linseed Products Co., Minneapolis, Minn	*New Britain:* C. W. Lines Co
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	WHEAT PRODUCTS.	
	Wheat Bran.	
15620*†	The Anthony Mills, Anthony, Kansas	*New Haven:* Crittenden Benham Co
		Guaranty
15557	Commander. Commander Mill Co., Minneapolis, Minn	*Guilford:* Fred. C. Morse
		Guaranty
15602*	Choice. Hecker-Jones-Jewell Milling Co., New York, N. Y	*Torrington:* D. L. Talcott
		Guaranty
15652†	The Hunter Milling Co., Wellington, Kansas.	*New London:* P. Swartz & Co
		Guaranty
15522†	Maple Leaf Milling Co., Limited, Toronto Canada	*East Haven:* F. A. Forbes
		Guaranty
15634	Maple Leaf Milling Co., Toronto, Canada	*Rockville:* Rockville Milling Co
		Guaranty
15647	Choice. Niagara Falls Milling Co., Niagara Falls, N. Y	*Norwich:* Chas. Slosberg & Son
		Guaranty
15645	Omar. Omaha Flour Mills Co., Omaha, Neb.	*Yantic:* Yantic Grain & Products Co
		Guaranty
15545	Thompson Milling Co., Lockport, N. Y	*Plantsville:* W. H. Cowles
		Guaranty
15665*	Washburn-Crosby Co., Minneapolis, Minn.	*New Haven:* R. G. Davis & Sons
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Wheat Feed (Mixed Feed).	
15605	Snowflake. Lawrenceburg Roller Mill Co., Lawrenceburg, Ind	*Winsted:* E. Manchester & & Sons
		Guaranty
15549*	Pillsbury's. Pillsbury Mills, Minneapolis, Minn	*Plainville:* Eaton Bros.
		Guaranty

*With screenings. † Wire tags.

INSPECTION OF 1920—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N.x625)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
15524	8.54	5.80	31.06	8.39	39.16	7.05	$70.00
.....	.....	.....	31.00	.....	.....	5.00	.....
15575	9.94	6.21	30.19	8.25	37.73	7.68	72.00
.....	.....	.....	31.00	.....	.....	5.00	.....
.....	.....	.....	**31.00**	.....	.....	**5.00**	.....
.....	**9.24**	**6.01**	**30.63**	**8.32**	**38.43**	**7.37**	**71.00**
.....	.....	.....	**27.26**	**4.74**	**29.98**	**6.56**	.....
15620	11.19	6.22	17.81	8.81	51.69	4.28	51.00
.....	.....	.....	14.50	10.00	.....	3.50	.....
15557	9.50	6.61	14.69	11.10	52.82	5.28	49.00
.....	.....	.....	13.00	.....	.....	3.50	.....
15602	9.97	5.56	16.94	9.32	52.62	5.59	48.00
.....	.....	.....	14.50	12.50	51.55	3.75	.....
15652	13.51	6.80	17.25	9.68	48.65	4.11	50.00
.....	.....	.....	14.50	11.00	52.00	3.50	.....
15522	9.10	5.49	17.63	10.37	51.38	6.03	31.00
.....	.....	.....	14.00	10.00	48.00	4.50	.....
15634	9.15	5.13	18.00	9.31	52.99	5.42	50.00
.....	.....	.....	15.50	.....	.....	4.50	.....
15647	12.57	5.60	18.31	12.40	45.25	5.87	48.00
.....	.....	.....	12.00	.....	.....	3.00	.....
15645	9.23	7.18	14.94	9.59	54.44	4.62	48.00
.....	.....	.....	14.50	11.00	50.00	3.50	.....
15545	9.81	6.76	16.13	9.88	52.54	4.88	47.00
.....	.....	.....	11.00	15.00	.....	3.00	.....
15665	10.92	5.06	17.44	10.62	50.15	5.81	.....
.....	.....	.....	13.00	.....	.....	4.50	.....
.....	.....	.....	**13.65**	**11.59**	**50.39**	**3.73**	.....
.....	**10.50**	**6.04**	**16.91**	**10.11**	**51.25**	**5.19**	**46.89**
.....	.....	.....	**12.85**	**4.35**	**37.93**	**3.22**	.....
15605	9.14	5.94	16.69	8.90	54.86	4.47	$55.00
.....	.....	.....	14.00	.....	.....	3.00	.....
15549	9.89	4.62	16.38	7.64	56.41	5.06	65.00
.....	.....	.....	14.00	.....	.....	4.00	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	WHEAT PRODUCTS—*Concluded.*	
	Wheat Feed (Mixed Feed)—Concluded.	
15556	Occident. Russell Miller Milling Co., Minneapolis, Minn.	*Guilford:* Fred C. Morse
		Guaranty
15534	Gold Mine. Sheffield King Milling Co., Minneapolis, Minn	*Ansonia:* Ansonia Flour & Grain Co
		Guaranty
15627	Kent. Williams Bros., Co., Kent, Ohio	*Granby:* E. H. Rollins
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Wheat Middlings.	
15533*	Bay State. Bay State Milling Co., Winona, Wis	*Ansonia:* Ansonia Flour & Grain Co
		Guaranty
15596*	Big Diamond. Big Diamond Mills Co., Minneapolis, Minn	*Waterbury:* Spencer Grain Co
		Guaranty
15554*	Madelia. C. S. Christenson Co., Madelia, Minn	*Branford:* S. V. Osborn
		Guaranty
15611	Duluth Universal Milling Co., Duluth, Minn.	*Hazardville:* A. D. Bridg Sons
		Guaranty
15640	Shorts. Jas. Goldie Co., Guelph, Ont	*Willimantic:* Boston Grain Store
		Guaranty
15600*	Hecker-Jones-Jewell Milling Co., New York	*Torrington:* D. L. Talcott
		Guaranty
15529	Black Hawk. International Milling Co., Minneapolis, Minn	*Hamden:* I. W. Beers
		Guaranty
15526	Rex. Maple Leaf Milling Co., Toronto, Canada	*East Haven:* F. A. Forbes
		Guaranty
15616	Alta. Russell Miller Milling Co., Minneapolis, Minn	*Suffield:* Spencer Bros
		Guaranty
15539	XXX Comet. Northwestern Consolidated Milling Co., Minneapolis, Minn	*Southport:* C. Buckingham & Co., Inc
		Guaranty
15619*	Ogilvie Flour Mills Co., Winnipeg, Canada	*New Haven:* Crittenden-Benham Co
		Guaranty
15563*	Pillsbury's B. Pillsbury Mills, Minneapolis, Minn	*Wallingford:* A. E. Hall
		Guaranty
15621	Quaker City. Quaker City Mills Co., Philadelphia, Pa	*New Haven:* R. G. Davis & Sons
		Guaranty

*With screenings.

INSPECTION OF 1920—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
556	10.35	5.44	18.31	7.89	52.36	5.65	$50.00
...	.....	.....	15.00	....	.....	4.50	.....
534	8.54	5.24	16.31	9.08	55.59	5.24	60.00
...	.....	.....	15.00	.....	....	4.50	.....
627	10.67	5.43	16.31	7.50	55.82	4.27	56.00
...	.....	.....	14.00	.....	......	3.00	.....
...	.....	.....	**14.40**	.....	.....	**3.80**	.....
...	**9.70**	**5.33**	**16.80**	**8.20**	**55.01**	**4.94**	**57.20**
...	.....	.....	**12.94**	**2.95**	**41.81**	**4.30**	.....
533	9.27	3.91	16.38	6.78	57.95	5.71	56.00
...	.....	.....	15.00	.....	.....	4.00	.....
596	9.28	4.92	16.88	8.45	55.49	4.98	50.00
...	.....	.....	15.00	....	....	4.50	.....
554	10.97	4.86	16.00	7.88	56.23	4.06	60.00
...	.....	.....	14.00	.....	.....	3.00	.....
511	8.62	3.44	17.00	4.92	60.54	5.48	60.00
...	.....	.....	15.00	.....	.....	5.00	.....
40	9.89	4.04	15.75	5.75	59.95	4.62	50.00
...	.....	.....	17.00	.....	.....	6.00	.....
00	9.18	5.08	17.06	7.56	55.88	5.24	50.00
..	.....	.....	15.50	10.00	54.24	4.50	.....
29	8.92	4.98	15.38	8.37	56.72	5.63	43.00
..	.....	....	14.00	.....	.....	3.50	.....
26	9.06	4.25	16.75	7.84	55.84	6.26	53.00
..	.....	.....	16.00	.....	.....	5.50	.....
16	10.31	4.11	17.00	6.89	55.98	5.71	70.00
..	.....	.....	15.00	.....	.....	4.50	.....
39	10.53	2.59	16.69	1.95	63.52	4.72	77.00
..	.....	.....	16.00	.....	.....	4.00	.....
19	11.03	4.00	17.50	7.20	54.47	5.77	51.00
..	.....	.....	13.00	.....	.....	4.00	.....
63	10.47	5.04	16.06	8.92	54.02	5.49	45.00
..	.....	.....	14.00	....	.....	4.00	.....
21	11.00	4.31	17.50	5.08	56.91	5.20	71.00
..	.....	.....	14.00	.....	.....	4.00	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	WHEAT PRODUCTS—*Concluded.* *Wheat Middlings—Concluded.*	
15603*	Pennant. David Stott Flour Mills, Detroit, Mich	*Torrington:* F. L. Wadhams & Son
		Guaranty
15558*	Angelus. Thompson Milling Co., Lockport, N. Y	*Guilford:* Fred C. Morse
		Guaranty
15573*	Standard. Washburn Crosby Co., Minneapolis, Minn	*New Britain:* C. W. Lines Co
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	RYE PRODUCTS.	
15562	Feed. Boutwell Mill & Grain Co., Troy, N. Y	*Wallingford:* A. E. Hall
		Guaranty
15630*	Middlings. Shane Bros. & Wilson Co., Minneapolis, Minn	*Hartford:* Meech Grain Co.
		Guaranty
	OAT PRODUCTS.	
15544	Purity Oat Feed. Purity Oat Co., Keokuk, Iowa	*Plantsville:* W. H. Cowles
		Guaranty
	MAIZE PRODUCTS. *Corn Gluten Feed.*	
15527	Cream of Corn. American Maize Products Co., New York	*East Haven:* F. A. Forbes
		Guaranty
15612	Cream of Corn. American Maize Products Co., Roby, Ind	*Hazardville:* A. D. Bridges Sons
		Guaranty
15528	Buffalo.‡ Corn Products Refining Co., New York	*Hamden:* I. W. Beers
		Guaranty
15551	Buffalo. Corn Products Refining Co., New York	*Branford:* S. V. Osborn
		Guaranty
15625	Globe. Corn Products Refining Co., New York	*Bristol:* Goodsell Bros.
		Guaranty
15561	Hubinger Bros. Co.,‡ Keokuk, Iowa	*North Haven:* W. L. Thorp
		Guaranty
15537	Staley's. A. E. Staley Mfg. Co., Decatur, Ill.	*Southport:* C. Buckingham & Co., Inc
		Guaranty
15579	Farmer Jones. U. S. Food Products Co., Peoria, Ill	*New Milford:* Geo. T. Sou
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible

*With screenings. ‡Statement of dealer.

INSPECTION OF 1920—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
15603	9.68	4.53	16.13	6.58	58.28	4.80	$32.00
....	.....	.....	15.00	.....	.....	4.00	.....
15558	11.77	3.85	17.75	6.14	55.38	5.11	60.00
....	.....	.....	11.00	15.00	.....	3.00	.....
15573	12.20	4.06	19.06	6.86	52.02	5.80	65.00
....	.....	.....	14.00	.....	.....	4.00	.....
....	.....	.....	**14.60**	.....	.....	**4.22**	.....
....	**10.13**	**4.25**	**16.81**	**6.70**	**56.82**	**5.29**	**55.81**
....	.....	.....	**12.94**	**2.01**	**44.32**	**4.66**	.....
15562	11.51	3.74	15.06	4.03	62.59	3.07	45.00
....	.....	.....	13.50	.....	.....	3.00	.....
5630	9.81	3.79	17.19	5.04	60.87	3.30	74.00
....	.....	.....	15.50	9.00	55.00	3.50	.....
5544	6.48	7.63	6.06	26.62	51.15	2.06	35.00
....	.....	.....	5.00	.....	.....	1.75	.....
5527	7.11	2.41	24.50	7.38	53.73	4.87	60.00
....	.....	.....	23.00	.....	.....	1.50	.....
5612	7.05	2.47	23.56	6.05	57.32	3.55	65.00
....	.....	.....	23.00	8.50	.....	1.50	.....
5528	8.37	4.76	26.38	5.69	50.09	4.71	60.00
....	.....	.....	23.00	.....	.....	1.00	.....
5551	8.69	5.18	26.44	7.05	50.17	2.47	60.00
....	.....	.....	23.00	.....	.....	1.00	.....
5625	8.83	2.89	26.56	6.04	54.52	1.16	60.00
....	.....	.....	23.00	.....	.....	1.00	.....
5561	9.34	2.05	22.88	5.93	56.41	3.39	62.00
....	.....	.....	.....	.....	.....	.....	.....
5537	7.65	4.60	26.06	7.71	51.73	2.25	63.00
....	.....	.....	23.00	.....	.....	1.00	.....
5579	7.99	2.06	25.94	7.12	49.86	7.03	60.00
....	.....	.....	23.00	9.50	.....	2.00	.....
....	.....	.....	**23.00**	.....	.....	**1.28**	.....
....	**8.14**	**3.30**	**25.30**	**6.62**	**52.98**	**3.68**	**61.25**
....	.....	.....	**21.41**	**4.93**	**46.62**	**3.10**	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	MAIZE PRODUCTS—*Concluded.* *Corn Meal.*	
15664		*New Haven:* R. G. Davis & Sons
		Guaranty
	Hominy Feed.	
15642	Homco. American Hominy Co., Indianpolis, Ind	*Willimantic:* Boston Grain Store
		Guaranty
15559†	Aunt Jemima Mills Co., St. Joseph, Mo	*Guilford:* Fred. C. Morse
		Guaranty
15636	Spring Garden. The Baltimore Pearl Hominy Co., Baltimore, Md	*Willimantic:* Willimanti Grain Co
		Guaranty
15560	Emco. Evans Milling Co., Indianapolis, Ind.	*North Haven:* W. L. Thorpe
		Guaranty
15626	White. Kellogg Toasted Corn Flake Co., Battle Creek, Mich	*Bristol:* Goodsell Bros
		Guaranty
15604	True Value. Ladish Milling Co., Milwaukee, Wis	*Torrington:* F. L. Wadams & Son
		Guaranty
15643	Miller Cereal Mills, Omaha, Neb	*Yantic:* Yantic Grain and Products Co
		Guaranty
15538	Choice Steam Cooked. Miner-Hillard Milling Co., Wilkes-Barre, Pa	*West Cheshire:* G. W. Thorpe
		Guaranty
15570†	The Patent Cereal Co., Geneva, N. Y	*Meriden:* August Grulich. Est
		Guaranty
15608	Plymouth's Pure. Plymouth Milling Co., Lemars, Iowa	*Winsted:* E. Manchester & Sons
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	DISTILLERS' PRODUCTS.	
15609	Eagle. Distillers' Dried Grains, The Dewey Bros., Blanchester, Ohio	*Winsted:* E. Manchester & Sons
		Guaranty
	MISCELLANEOUS FEEDS.	
15649	Dried Beet Pulp. Kasco Mills, Inc., Toledo, Ohio	*New London:* Conn. Grain Corp
		Guaranty
15651	Dried Beet Pulp. Max Hottelet, Milwaukee, Wis	*New London:* P. Schwart & Co
		Guaranty

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†Wire tags.

INSPECTION OF 1920—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
15664	16.00	1.23	8.44	2.06	68.99	3.28	$.....
.....	.....	.....	.....	.....	.....	.....	.....
15642	7.92	2.62	11.25	4.51	65.44	8.26	45.00
.....	.....	.....	10.00	6.00	.....	6.00	.....
15559	9.99	3.44	12.19	5.82	63.38	5.18	50.00
.....	.....	.....	10.00	8.00	65.00	5.00	.....
15636	8.82	2.46	10.94	4.58	67.21	5.99	50.00
.....	.....	.....	10.00	6.00	60.00	5.00	.....
15560	9.74	2.98	11.75	5.02	60.45	10.06	49.00
.....	.....	.....	10.00	7.00	.....	7.50	.....
15626	9.68	2.73	11.44	4.16	63.22	8.77	56.00
.....	.....	.....	10.00	5.00	55.00	6.00	.....
15604	7.35	2.30	10.94	3.48	69.20	6.73	33.00
.....	.....	.....	10.50	5.00	.....	5.00	.....
15643	9.17	2.91	11.44	4.69	63.47	8.32	50.00
.....	.....	.....	10.00	4.00	65.00	7.00	.....
15538	10.19	2.44	11.19	5.13	65.69	5.36	49.00
.....	.....	.....	10.00	5.00	.....	4.00	.....
15570	10.23	2.44	11.13	5.55	64.03	6.62	50.00
.....	.....	.....	10.00	.....	.....	5.00	.....
15608	7.98	2.20	10.75	4.20	67.32	7.55	52.00
.....	.....	.....	10.00	.....	.....	8.50	.....
.....	.....	.....	**10.05**	**6.00**	.....	**5.90**	.....
.....	**9.11**	**2.65**	**11.30**	**4.71**	**64.94**	**7.29**	**48.40**
.....	.....	.....	**8.78**	**3.58**	**58.45**	**6.63**	.....
15609	5.23	1.71	32.69	11.02	35.95	13.40	72.00
.....	.....	.....	30.00	13.00	30.00	10.00	......
15649	10.73	3.38	9.00	18.84	56.18	1.87	60.00
.....	.....	.....	9.00	18.00	.....	0.50	.....
15651	9.40	3.26	9.00	20.24	56.63	1.47	60.00
.....	.....	.....	8.00	20.00	60.00	0.50	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	MISCELLANEOUS FEEDS—*Concluded.*	
15565	Dried Beet Pulp. Larrowe Milling Co., Detroit, Mich	*Wallingford:* A. E. Hall
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
15658	Cocoanut Oil Meal. Oil Seeds Co., Bayonne, N. J	*Middletown:* Meech & Stoddard, Inc
		Guaranty
15657	Beta Brand Peanut Oil Meal. Oil Seeds Co., Bayonne, N. J	*Middletown:* Meech & Stoddard, Inc
		Guaranty
	PROPRIETARY MIXED FEEDS.	
	Horse, Dairy and Stock Feeds.	
15655	Blatchford's Calf Meal. Blatchford Calf Meal Co., Wauregan, Ill	*Middletown:* Meech & Stoddard, Inc
		Guaranty
15525	Schumacher's Calf Meal. Quaker Oats Co., Chicago, Ill	*East Haven:* F. A. Forbes
		Guaranty
15639	Ryde's Cream Calf Meal. Ryde & Co., Chicago, Ill	*Willimantic:* Willimantic Grain Co
		Guaranty
15632	Hamlin Quality Horse Feed. Dwight Hamlin, Pittsburgh, Pa	*Hartford:* Meech Grain Co.
		Guaranty
15577	Peter's King Corn Horse and Mule Feed. M. C. Peters Mills Co., Omaha, Neb	*Shelton:* Ansonia Flour & Grain Co
		Guaranty
15572	Purina O-Molene Feed. Purina Mills, St. Louis	*Meriden:* August Grulich, Est
		Guaranty
15622	Farmer Jones Horse Feed. U. S. Food Products Co., Peoria, Ill	*New Haven:* R. G. Davis & Sons
		Guaranty
15656	Pioneer Hog Feed. Hales & Edwards Chicago, Ill	*Middletown:* Meech & Stoddard, Inc
		Guaranty
15566	Barford's Ready Ration for Growing Pigs. Meech & Stoddard, Inc., Middletown	*Meriden:* Meriden Grain & Coal Co
		Guaranty
15594	Go-Tu-It Hog Ration. Park & Pollard Co., Boston	*Norwalk:* C. E. Slauson Co.
		Guaranty
15576	Peters Hog Profit. M. C. Peters Mill Co., Omaha, Neb	*Shelton:* Ansonia Flour and Grain Co
		Guaranty
15571	Purina Pig Chow. Purina Mills, Buffalo, N. Y	*Meriden:* August Grulich. Est
		Guaranty

INSPECTION OF 1920—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
15565	6.95	3.28	8.56	19.30	61.20	0.71	$58.00
.....	.....	.....	8.00	20.00	58.00	0.50	......
.....	.....	.....	8.33	19.33	59.00	0.50	.....
.....	9.03	3.31	8.85	19.46	58.00	1.35	59.33
.....	.....	.....	4.60	16.15	48.14	.....	.....
15658	12.96	8.44	19.06	12.28	35.17	12.09	.....
.....	.....	.....	20.00	.....	.....	7.00	.....
15657	14.51	6.20	27.94	10.81	27.84	12.70	.....
.....	.....	.....	30.00	10.00	.....	7.00	.....
15655	13.96	6.00	23.19	8.31	43.76	4.78	130.00
.....	.....	.....	24.00	.....	.....	5.00	.....
15525	7.74	5.21	19.50	2.06	57.51	7.98	115.00
.....	.....	.....	18.00	.....	.....	8.00	.....
15639	8.17	5.39	25.19	6.53	49.79	4.93	140.00
.....	.....	.....	25.00	.....	.....	5.00	.....
15632	7.57	7.89	9.00	13.65	59.86	2.03	62.00
.....	.....	.....	9.00	14.00	.....	1.50	.....
15577	7.96	6.44	11.06	16.06	56.25	2.23	65.00
.....	.....	.....	10.00	.....	.....	1.50	.....
15572	9.72	3.87	10.56	6.37	65.38	4.10	58.00
.....	.....	.....	9.75	.....	.....	3.00	.....
15622	9.54	3.85	10.94	7.18	64.66	3.83	60.00
.....	.....	.....	10.00	.....	.....	2.50	....
15656	12.30	5.48	16.88	9.03	52.99	3.32	58.00
.....	.....	.....	15.00	.....	.....	4.00	.....
15566	9.64	4.43	18.75	6.90	53.68	6.60	61.00
.....	.....	.....	18.00	.....	.....	5.00	.....
15594	8.43	9.74	18.25	6.95	50.71	5.92	75.00
.....	.....	.....	15.00	.....	.....	6.00	.....
15576	10.88	6.28	19.25	5.63	52.95	5.01	88.00
.....	.....	.....	17.00	.....	.....	4.00	.....
15571	11.63	8.78	17.06	5.47	52.71	4.35	65.00
.....	.....	.....	15.00	9.00	59.00	2.50	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
15615	Portage Stock Feed. Akron Feed & Milling Co., Akron, Ohio	*Thompsonville:* Geo.S.Phelps & Co
		Guaranty
15536	Armour's Stock Feed. Armour Grain Co., Chicago, Ill	*Southport:* C. Buckingham & Co., Inc
		Guaranty
15617	Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass	*Suffield:* Spencer Bros
		Guaranty
15641	Crosby's Stock Feed. E. Crosby & Co., Brattleboro, Vt	*Willimantic:* Boston Grain Store
		Guaranty
15637	Grandin's Stock Feed. D. H. Grandin Milling Co., Jamestown, N. Y	*Willimantic:* Willimantic Grain Co
		Guaranty
15653	Stock Feed. Hales & Edwards,‡ Chicago, Ill	*New London:* P. Swartz & Co
		Guaranty
15614	Krause Stock Feed. Charles A. Krause, Milwaukee, Wis	*Thompsonville:* George S. Phelps & Co
		Guaranty
15583	Bull Brand Stock Feed. Maritime Trading Corp., Buffalo, N. Y	*New Milford:* George E. Ackley
		Guaranty
15587	M. & S. Stock Feed. Meech & Stoddard, Inc., Middletown, Conn	*Danbury:* H. E. Meeker
		Guaranty
15650	Old Honesty Stock Feed. Oswego Milling Co., Oswego, N. Y	*New London:* P. Schwartz & Co
		Guaranty
15610	Schumacher Feed. Quaker Oats Co., Chicago, Ill	*Hazardville:* A. D. Bridges Sons
		Guaranty
15531	Vitality Stock Feed. Rosenbaum Bros., Chicago, Ill	*Hamden:* I. W. Beers
		Guaranty
15646	Haskell's Stock Feed. Sheets Elevator Co., Haskell Mills, Toledo, Ohio	*Norwich:* Charles Slosberg Sons
		Guaranty
15530	Armour's Dairy Feed. Armour Grain Co., Chicago	*Hamden:* I. W. Beers
		Guaranty
15553†	Acorn Dairy Feed. Chapin & Co., Hammond, Ind	*Branford:* S. V. Osborn
		Guaranty
15589	Unicorn Dairy Ration. Chapin & Co., Hammond, Ind	*Danbury:* F. C. Benjamin
		Guaranty
15541	Wirthmore Balanced Ration for Milch Cows. Chas. M. Cox Co., Boston, Mass	*West Cheshire:* G. W.Thorpe,
		Guaranty
15629	Crosby's Quality Feed Dairy Ration. E. Crosby & Co., Brattleboro, Vt	*Hartford:* Meech Grain Co
		Guaranty

†Wire tags. ‡Statement of dealer.

INSPECTION OF 1920—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
15615	8.35	4.27	10.13	10.96	61.54	4.75	$55.00
.....	.....	.....	8.50	10.00	.....	4.00	.....
15536	6.99	4.78	12.63	12.47	58.20	4.93	50.00
.....	.....	.....	12.00	.....	.....	4.00	.....
15617	8.03	3.68	10.50	8.73	63.76	5.30	60.00
.....	.....	.....	9.00	.....	.....	4.00	.....
15641	9.16	2.94	10.44	7.03	65.25	5.18	48.00
.....	.....	.....	9.00	10.00	60.00	4.00	.....
15637	8.55	3.73	9.13	10.50	62.36	5.73	50.00
.....	.....	.....	10.00	.....	.....	4.00	.....
15653	10.80	5.43	12.56	10.46	57.58	3.17	50.00
.....	.....	.....	10.00	.....	.....	4.00	.....
15614	8.76	2.88	10.31	7.87	66.90	3.28	55.00
.....	.....	.....	9.00	.....	.....	3.00	.....
15583	8.70	4.72	13.81	8.77	58.71	5.29	60.00
.....	.....	.....	11.00	12.00	60.00	4.00	.....
15587	8.53	3.85	10.63	9.85	61.74	5.40	60.00
.....	.....	.....	9.00	.....	.....	3.00	.....
15650	10.16	4.64	11.25	11.46	58.60	3.89	50.00
.....	.....	.....	10.00	.....	.....	3.00	.....
15610	9.29	5.50	11.00	9.26	61.80	3.15	55.00
.....	.....	.....	10.00	.....	.....	3.25	.....
15531	7.86	7.04	10.31	12.24	58.80	3.75	55.00
.....	.....	.....	12.00	.....	.....	3.00	.....
15646	7.39	3.27	9.63	9.75	63.75	6.21	50.00
.....	.....	.....	9.00	.....	.....	6.00	.....
15530	7.09	7.25	27.69	13.55	38.48	5.94	72.00
.....	.....	.....	22.00	.....	.....	5.00	.....
15553	9.12	6.23	20.00	8.17	51.93	4.55	70.00
.....	.....	.....	20.00	10.00	.....	3.00	.....
15589	8.41	6.96	24.88	7.49	46.36	5.90	72.00
....	.....	.....	24.00	.....	.....	4.50	.....
15541	8.99	5.32	24.19	10.60	45.85	5.05	65.00
.....	.....	.....	24.00	.....	.....	5.00	.....
15629	8.85	4.93	23.88	10.47	46.23	5.64	73.00
.....	.....	.....	25.00	.....	.....	5.00	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS.

Station No.	Manufacturer and Brand.	Retail Dealer.
	PRORPIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
15599	Eshelman's 20 Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa	*Torrington:* D. L. Talcott Guaranty
15588	Eshelman's 24 Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa	*Danbury:* F. C. Benjamin Guaranty
15638	Grandin's Twin-Six Dairy Feed. D. H. Grandin Milling Co., Jamestown, N. Y.	*Willimantic:* Williamantic Grain Co Guaranty
15623	Al Grane Milk Feed. H-O Co.'s Mills, Buffalo, N. Y.	*Bristol:* Goodsell Bros Guaranty
15547	National Dairy Feed. Ladish Milling Co., Milwaukee, Wis.	*Plantsville:* W. H. Cowles Guaranty
15613	Larro Feed for Dairy Cows. Larrowe Milling Co, Detroit, Mich.	*Thompsonville:* George S. Phelps & Co Guaranty
15607	Red Star Dairy Feed. E. Manchester & Sons, Winsted, Conn	*Winsted:* E. Manchester & Sons Guaranty
15567	Barford's Balanced Dairy Ration. Meech & Stoddard, Middletown, Conn	*Meriden:* Meriden Grain & Coal Co Guaranty
15633	Barford's Balanced Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.	*Hartford:* Meech Grain Co. Guaranty
15597	Steven's 44 Dairy Ration. Park & Pollard Co., Boston, Mass	*Waterbury:* Spencer Grain Co Guaranty
15574	Pillsbury's Dairy Ration. Pillsbury Flour Mill Co., Minneapolis, Minn	*New Britain:* C. W. Lines Co Guaranty
15592	Purina Cow Chow. Purina Mills, Buffalo, N. Y.	*Norwalk:* C. E. Slauson Co. Guaranty
15591	Protena More Milk Dairy Feed. Purina Mills, St. Louis	*Norwalk:* C. E. Slauson Co. Guaranty
15535	Big Q Dairy Ration. Quaker Oats Co., Chicago, Ill	*Ansonia:* Ansonia Flour & Grain Co Guaranty
15590	Quaker Dairy Feed Without Molasses. Quaker Oats Co., Chicago	*Danbury:* F. C. Benjamin Guaranty
15546	Syragold Milk Ration. Syracuse Milling Co., Syracuse, N. Y.	*Plantsville:* W. H. Cowles Guaranty
15578	Ti-O-Ga Dairy Feed. Tioga Mill & Elevator Co., Waverly, N. Y.	*New Milford:* Geo. T. Soule Guaranty
15644	Biles Ready Dairy Ration. The Ubiko Milling Co., Cincinnati, Ohio	*Yantic:* Yantic Grain and Products Co Guaranty
15550	Fourex Dairy Ration. The Ubiko Milling Co., Cincinnati, Ohio	*Plainville:* Eaton Bros Guaranty

INSPECTION OF 1920—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N.x6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
15599	9.81	7.34	17.56	12.03	48.34	4.92	$68.00
.....	.....	.....	20.00	.....	.....	4.00	.....
15588	7.83	6.44	25.50	11.85	42.50	5.88	70.00
.....	.....	.....	24.00	.....	.....	5.00	.....
15638	7.53	6.09	22.31	12.03	46.67	5.37	60.00
.....	.....	.....	22.00	.....	.....	5.00	.....
15623	9.47	6.21	15.38	11.28	53.55	4.11	60.00
.....	.....	.....	14.00	15.00	.....	4.00	.....
15547	9.59	6.18	25.13	8.76	44.14	6.20	70.00
.....	.....	.....	20.00	12.00	55.00	4.00	.....
15613	7.82	5.72	22.31	10.23	49.40	4.52	75.00
.....	.....	.....	20.00	.....	.....	3.00	.....
15607	8.42	5.11	24.50	8.79	46.50	6.68	67.00
.....	.....	.....	23.00	10.00	.....	4.00	.....
15567	9.24	4.90	21.50	8.40	47.98	7.98	60.00
.....	.....	.....	19.00	.....	.....	5.50	.....
15633	7.92	5.38	19.13	9.03	51.41	7.13	78.00
.....	.....	.....	19.00	.....	.....	5.50	.....
15597	6.94	8.37	26.88	10.86	38.47	7.48	75.00
.....	.....	.....	24.00	.....	.....	5.00	.....
15574	8.61	6.82	19.38	10.14	50.23	4.82	72.00
.....	.....	.....	19.00	.....	.....	4.00	.....
15592	8.58	6.43	26.56	10.74	43.17	4.52	75.00
.....	.....	.....	24.00	12.00	53.00	4.30	.....
15591	8.20	7.12	18.75	10.13	51.30	4.50	60.00
.....	.....	.....	16.50	.....	.....	3.50	.....
15535	7.46	5.22	22.06	10.78	48.97	5.51	73.00
.....	.....	.....	22.00	.....	.....	5.00	.....
15590	7.68	9.08	16.69	13.57	48.25	4.73	65.00
.....	.....	.....	16.00	.....	.....	4.50	.....
15546	9.50	5.76	20.56	17.74	42.11	4.33	70.00
.....	.....	.....	20.00	15.00	43.00	4.50	.....
15578	9.32	6.88	29.06	8.06	41.60	5.08	68.00
.....	.....	.....	23.00	11.00	.....	3.50	.....
15644	7.83	5.28	24.13	8.29	47.71	6.76	70.00
.....	.....	.....	24.00	10.00	50.00	5.00	.....
15550	8.89	6.74	20.81	10.55	48.56	4.45	65.00
.....	.....	.....	20.00	12.00	52.00	4.00	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Concluded.* *Horse, Dairy and Stock Feeds—Concluded.*	
15552	Big Repeater Dairy Ration. U. S. Feed Association, Toledo, Ohio................	*Branford:* S. V. Osborn.... Guaranty................
15542	Farmer Jones Dairy Feed. U. S. Food Products Co., Peoria, Ill.................	*West Cheshire:* G. W. Thorpe Guaranty................
15543	Success Dairy Feed. U. S. Food Products Co., Peoria, Ill.............................	*West Cheshire:* G. W. Thorpe Guaranty................
15667	Dairy Feed............................	*New Haven:* R. G. Davis & Sons.................. Guaranty................
	POULTRY FEEDS.	
15585	Blatchford's Fill the Basket Egg Mash. Blatchford Calf Meal Co., Wauregan, Ill..	*New Milford:* Geo. E. Ackley Guaranty................
15569	Iroquois Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y...........................	*Meriden:* Meriden Grain & Coal Co................ Guaranty................
15582	Wirthmore Mash Feed. Chas. M. Cox, Boston, Mass...........................	*New Milford:* Geo. T. Soule Guaranty................
15624	H. O. Co.'s Laying Mash. H. O. Co.'s Mills, Buffalo, N. Y...........................	*Bristol:* Goodsell Bros...... Guaranty................
15568	M. & S. Dry Mash. Meech & Stoddard, Middletown, Conn........................	*Meriden:* Meriden Grain & Coal Co................ Guaranty................
15648	Mystic Laying Mash. Mystic Milling & Feed Co., Rochester, N. Y..................	*Norwich:* Chas. Slosberg & Son.................... Guaranty................
15593	Lay or Bust. Park and Pollard Co., Boston, Mass.................................	*Norwalk:* C. E. Slauson Co. Guaranty................
15618	Purina Chicken Chowder. Purina Mills, St. Louis..............................	*New Haven:* Crittenden-Benham Co............. Guaranty................
15595	Full-O-Pep Growing Mash. Quaker Oats Co., Ill..................................	*Norwalk:* C. E. Slauson Co.. Guaranty................

15334. Beef Scrap, sent by H. H. Johnson, County Agent, Norwich, contained 55.88 per cent. of protein.

14350. Cane Molar, molasses used in the preparation of stock feeds was found to contain only a trace of sulphur dioxide.

Condimental Foods, Tonics, etc. **14468.** Sample sent by Mrs. George Middleton, North Windham, consisted of mixed ground grains, mainly corn, oats and wheat. No evidence of medicaments was found.

15441. Stock Feed Tonic, sent by B. S. Dibble, East Canaan, consisted of, or contained, salt, charcoal, partially digested starchy material, bicarbonate of soda, sulphur, quassia, chaff, and weed seeds. Epsom salt and limestone or shells were indicated.

INSPECTION OF 1920—*Concluded.*

Station No.	Pounds per Hundred.						Price per ton.
	Water	Ash.	Protein (N.x6.25).	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
15552	8.84	5.36	22.88	9.21	48.55	5.16	$70.00
.....	.....	.....	22.00	.....	.....	5.00	.....
15542	8.85	7.28	24.50	7.54	47.01	4.82[1]	65.00
.....	.....	.....	20.00	.....	.....	5.00	....
15543	9.39	7.80	22.81	7.20	48.38	4.42	60.00
.....	.....	.....	16.00	.....	.....	4.00	.....
15667	11.67	3.44	19.44	7.01	53.26	5.18	.....
.....	.....	.....	.....	.....	.....	.....	.....
15585	8.18	14.43	21.31	8.72	42.05	5.31	100.00
.....	.....	.....	19.00	.....	.....	4.00	.....
15569	8.86	5.08	16.25	8.04	55.80	5.97	63.00
.....	.....	.....	15.00	.....	.....	4.00	.....
15582	9.77	9.43	23.13	5.69	46.64	5.34	78.00
.....	.....	.....	20.00	.....	.....	4.00	.....
15624	9.20	10.88	20.00	5.23	49.23	5.46	75.00
.....	.....	.....	17.00	6.00	......	4.50	.....
15568	9.62	8.68	19.81	6.63	49.01	6.25	60.00
.....	.....	.....	12.00	.....	.....	3.00	.....
15648	11.85	8.60	23.75	9.60	41.93	4.27	78.00
.....	.....	.....	23.00	.....	.....	4.00	.....
15593	8.52	12.04	18.19	7.62	49.76	3.87	75.00
.....	.....	.....	18.00	.....	.....	1.50	.....
15618	9.50	7.46	20.06	8.51	49.71	4.76	81.00
.....	.....	.....	18.00	.....	.....	4.00	.....
15595	8.24	9.60	19.63	4.88	52.58	5.07	90.00
.....	.....	.....	17.00	.....	.....	5.25	.....

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[1] By modified method; 4.52 by regular method.

FEEDS SUSPECTED OF CONTAINING FOREIGN OR INJURIOUS MATERIALS.

15252. Oats suspected of having been sulphured, sent by R. E. Macey, West Haven. No evidence of bleaching was obtained.

15305. Shelled corn and peanut feed, sent by Mrs. William Lord, Noroton Heights, was referred to the Department of Entomology. Dr. Britton reported the sample to be moderately infested with the rice weevil and slightly infested with the Indian meal moth.

14982. Scratch Feed and **14983.** Chick Feed, sent by E. Johnson, Thomaston. There was nothing suspicious about the substance of the feeds but **14982,** in our opinion, was entirely too coarse for young chicks.

CONNECTICUT
Agricultural Experiment Station
NEW HAVEN, CONN.

BULLETIN 230 **JUNE, 1921**

ENTOMOLOGICAL SERIES, No. 29

THE GRASS-FEEDING FROG-HOPPER OR SPITTLE-BUG

By Philip Garman

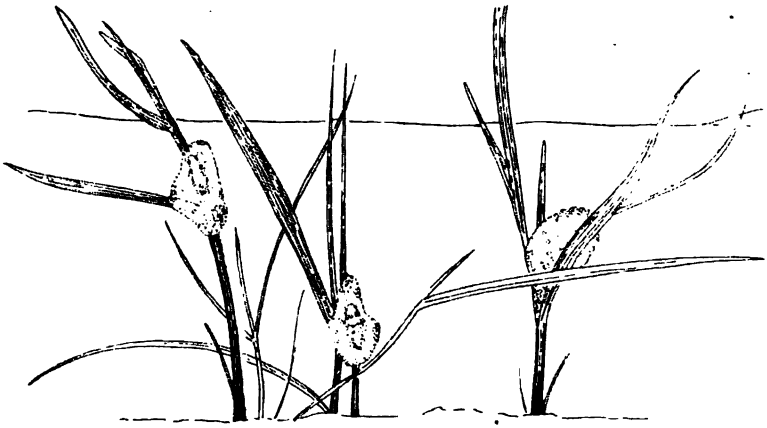

Figure 17. Spittle balls containing nymphs on grass stems

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the edition permits.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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June, 1921.

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Press of The Wilson H. Lee Company.

The Grass-Feeding Frog-Hopper or Spittle-Bug

(*Philaenus lineatus* Linnaeus)

Order *Hemiptera* Family *Cercopidae*

By Philip Garman, Ph.D.

Frog-hopper or spittle-bug balls are often observed on shrubbery or herbaceous plants, in waste or uncultivated fields. Those of the grass-feeding species are especially noticeable in meadows and may cause persons not acquainted with them to speculate—often blindly—concerning their probable nature. Such speculations are mainly confined to the belief in "frog-spit" and "snake-spit," though occasionally we find people who think them the young of grasshoppers. The term "frog-hopper," which has grown out of the unfounded belief that spittle balls are voided by tree-frogs, is not inappropriate when applied to the adult bug because of its squat appearance and hopping ability.

In favorable locations frog-hoppers may become abundant and no doubt do considerable damage. In one instance the writer counted fourteen balls on grass plants within a square foot, which shows the relative abundance of frog-hoppers under some conditions. About New Haven they do not become sufficiently numerous to do serious damage, but they contribute to the sum total of injury caused by leaf-hoppers, grasshoppers and thrips, and may be counted a pest for this reason.

Frog-hoppers are sucking insects which make use of the sap drawn from the plant, to form their protective spittle. Any withdrawal of sap in this way naturally weakens the plant, and the stem upon which the insect has fed may become stunted or may not produce seed.

Orchard grass, timothy, red top and blue grass are infested in Connecticut, while Osborn[5] reports it also from Canada blue grass in Maine. The adults likewise feed on grass shoots but apparently do not do as much damage as the nymphs.

Those who have studied the life histories of American Cercopidae have not reported direct field observation of the egg stage of any of them; nor have they followed these insects through their complete cycle from egg to egg or adult to adult.

Some of the missing links in our chain of information have been observed for the grass-feeding spittle-bug and an effort has been made to follow it through its life cycle by observations in the field, insectary and laboratory. These facts are herein recorded.

History

Osborn[5] studied the species of Maine Cercopidae and his observations are of especial value. He says of the grass-feeding species that it lives through the winter in the egg stage. The eggs hatch late in May or early in June, and the nymph passes through several stages (3-4) before the adult emerges. Adults were obtained in Maine the first part of July and probably mate there in August. Egg laying is extended over "some weeks in autumn." Ball in his summary of the life history of Cercopidae[1] says that all species except one pass the winter in the egg stage.

The Egg

Confined in small wire cages placed over grass planted in flower pots, the adult bugs were induced to mate and lay eggs. The eggs are laid between the leaf and the main stem (Fig. 18, e), are usually placed diagonally to the stem, and within two or three inches of the ground. They are firmly attached to the plant, either to leaf or stem. As many as eleven have been found in one group but they are sometimes laid singly. Cage records indicate that four or five are usually deposited together.

In 1920 eggs were obtained on the following dates from adult females brought from the field and mated in the insectary:—July 12, 16, 25, 29; August 2, 3, 5, 7, 8, 10, 11, 14, 15, 19, 21, 31; September 9, 12 and 20. In 1921 the first eggs were obtained July 7, but could probably have been obtained earlier judging from the time of adult emergence. In 1920 adults were mated July 1, but no eggs were obtained. Of the eggs obtained in 1920, those laid on July 19, 25, 29; August 5, 6, 7, 12, 14, 26; September 7, 9 and 17, hatched the following spring, the period of incubation varying from 228 to 281 days.

Table Giving Data on the Length of the Egg Stage.

Eggs Laid	Eggs Hatched	Length of Period (Days)
July 19, 1920	April 26, 1921	281
July 25, 1920	May 6, 1921	275
July 29, 1920	April 27, 1921	272
August 5, 1920	April 30, 1921	268
August 5, 1920	April 27, 1921	265
August 5, 1920	April 27, 1921	265
August 8, 1920	April 25, 1921	260
August 7, 1920	April 30, 1921	266
August 8, 1920	April 26, 1921	261
August 9, 1920	April 30, 1921	264
August 10, 1920	April 20–26, 1921	253–259
August 14, 1920	April 26, 1921	255
August 14, 1920	April 25, 1921	254
August 15, 1920	April 26, 1921	254
August 14, 1920	April 26, 1921	255
August 14, 1920	April 25, 1921	254
August 31, 1920	April 26, 1921	239
September 9, 1920	April 25, 1921	228
September 12, 1920	April 28, 1921	228
September 17, 1920	May 8, 1921	233

It is interesting to note in addition to the fact that the incubation period varied from 228-281 days in 1920-'21, that the eggs laid between July 19-September 17 hatched within a short time of one another. These eggs were all placed out of doors as soon as laid and brought to the insectary after frost. Furthermore, it was noted in field cages that all hatched about the same time in 1920; viz., April 20, and that young were first seen in the field about this time both in shaded and exposed situations.

THE NYMPH

The nymph passes through four instars, and the nymphal stage lasts about forty-five days, according to field observations. In 1920 spittle balls were observed from June 1 to August 13, though most of them disappeared about July 4. In 1921 nymphs were present in field cages from April 20 to June 14. The average sum of the different stages obtained in the insectary totals twenty-eight days, and it seems probable that the usual period lies between twenty-eight and forty-five days in this latitude, though possibly more, or less.

The first stage nymphs lived in 1921 from—

April 27 to May 10	13 days
April 20 to May 3	13 days
April 26 to May 11	15 days
April 26 to May 10	15 days
April 26 to May 11	15 days
April 28 to May 11	13 days
April 26 to May 11	15 days

The mean hourly temperature in the insectary during the period from April 26 to May 11 was 56° F; maximum 76°; minimum 45° F. During 19 hours of this period the temperature registered below 50° F.

The second stage collected from the field in 1920 lived from:—

June 8 to June 12	4 days
June 8 to June 9	1 day.

Data on this stage are very unsatisfactory. Two specimens in the third instar collected from the field in 1920 lived from June 8 to June 12, four days, but these also are unsatisfactory data.

The fourth instar in 1920 lived from:—

June 12 to June 20	8 days
June 9 to June 20	11 days
June 12 to June 18	6 days
June 8 to June 18	10 days
June 8 to June 15	7 days

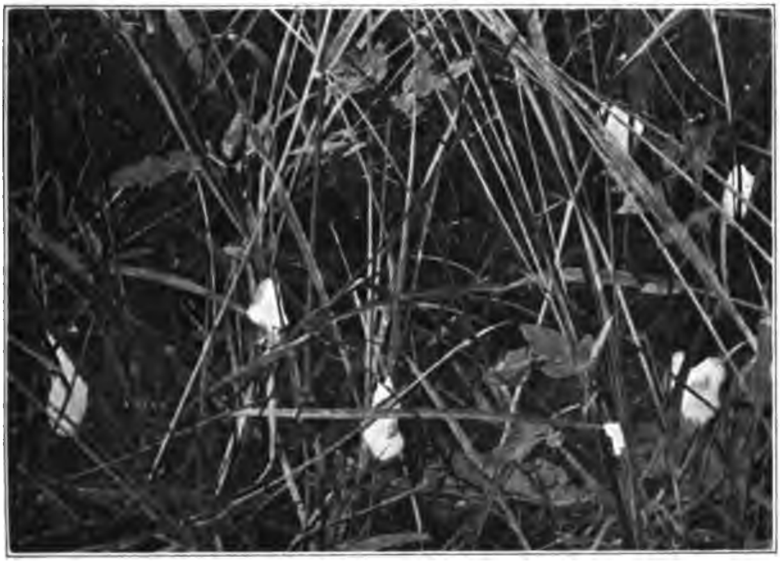
Osborn reared this stage in Maine in 2-6 days.

In field cages, nymphs hatched about April 20, and the first adults were seen June 14. Insectary temperature during this period varied from 45° - 82° F. The mean hourly temperature during April (April 26 to May 1) was 60.1° F., during May, 57.1° F; and during June (1-14) 60.3° F. For about 60 hours of this period the temperature was below 50° F.

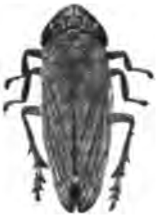
Habits of the Nymph

The newly emerged nymph has a yellow spot on each side of the abdomen. These spots probably mark the location of the spittle glands, the openings of which are on the seventh and eighth segments. While some of the material for the spittle comes from the anal opening, a great part must come from these abdominal glands, the substance flowing beneath the abdomen where it is filled with air bubbles. The apparatus for filling the mass with air bubbles is curious and is connected with a special adaptation for supplying air to the insect itself. In young nymphs the ventral surface of the abdomen is covered with a film of gelatinous material, allowing a space beneath it which connects with the space between the flap-like plates of the terminal segments. Air is drawn beneath this film, the insect keeping the tip of the abdomen above the surface when quiet. Spiracles connecting with air tubes are located on the ventral surface, between pleura and sterna and are covered by the film, in young specimens, and by a series of overlapping plates—extensions of the pleura—in older ones. The insect is enabled in this way to obtain a continual supply of air and at the same time remain submerged in the spittle. When the insect desires to expand the froth it sticks the abdomen above the spittle, encloses an air bubble within the two terminal flaps, brings it beneath the surface and forces it out. Some species, however, are able to work faster. Placing the tip of the abdomen near the surface of the spittle they roll the terminal flaps together rapidly, taking air in and expelling it beneath the surface of the spittle, at the same time moving the tip of the abdomen but little.

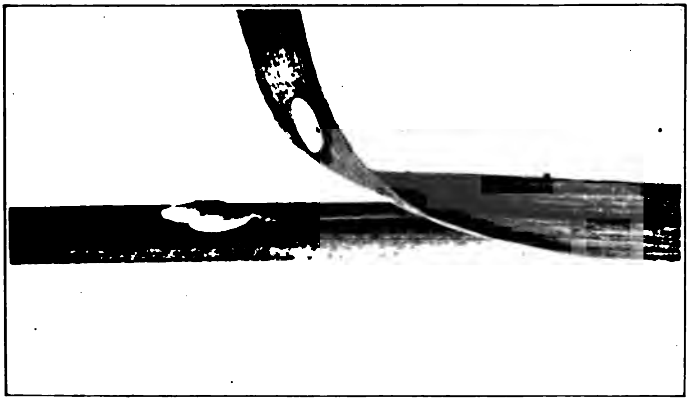
Expansion of the froth with air serves to hide the nymph and makes excessive secretion unnecessary. During nymphal life the bug may construct several balls but there is usually little migration after the first mass is formed. Moults take place within the froth and in the case of the grass-feeding frog-hopper, the adult also develops within where it hardens sufficiently to enable it to fly. Thus during nymphal life at least, the grass-feeding spittle-bug is protected from predaceous and parasitic enemies and partly from adverse climatic conditions. Lack of moisture seems to prevent development of the younger stages which depend largely on tender rapidly growing shoots as a food supply. The result is seen in their more frequent occurrence in low damp places than in higher well drained pastures.



a. Spittle balls on grass About natural size Photo by Walden.



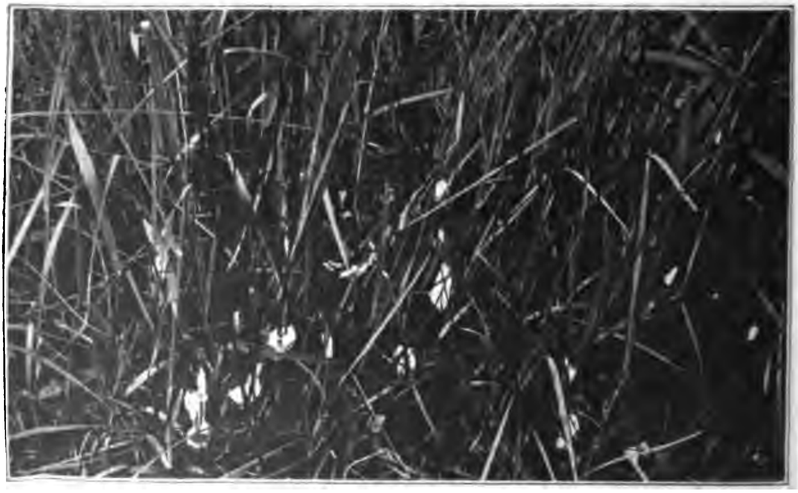
b. Adult bug. Six times natural size.



c. Eggs on grass. Eight times natural size. Photo by Walden.

PLATE XIX

a. Field with spittle-masses. Photo by Walden.



b. Grass infested with frog-hoppers, showing spittle-masses. Photo by Walden.

COMPOSITION OF THE FROTH

Osborn[5] says that the froth mass is only partly soluble in water. This is true since the balls often remain on the stems after showers. The substance is more readily soluble in sodium hydroxide, but is not easily soluble in 80% alcohol. It probably contains some starch or converted sugar, though there is no reaction to iodine. The "albuminous" substance is not coagulated with heat. The material of spittle balls offers an ideal medium for molds and bacteria which may sometimes be found in large numbers.

THE ADULT

Adults were collected from grass plots near the Station from June 15 to November 9, 1920, and specimens were taken on May 29, 1921, by Mr. Walden. None could be found in the spring of 1921, prior to May 29, in the field where spittle balls and adults were numerous in 1920. None of the adults survived in field cages, although some laid eggs which hatched the following spring. About two dozen adults in a field cage disappeared completely during the summer but laid eggs which hatched about April 20. Another field cage contained two dozen nymphs; all were adult July 4, and they lived in this state until about August 16, when no live individuals could be found. Eggs were laid by these bugs, and recently hatched nymphs were found April 20, 1921.

The adults apparently lay but few eggs. In breeding cages not over one dozen eggs could be obtained from a single female, though it is probable that they may lay more under suitable conditions. Most individuals laid one or two lots of eggs consisting of four or five each, and then died, in spite of efforts to keep them alive and obtain more eggs. Two gravid females collected in the field August 27, contained 4 and 12 well developed eggs respectively, while two others collected in July contained 0 and 4 eggs.

The period elapsing between emergence of the adult and egg laying is about a month. In 1920 adults were obtained in the field June 15 and the first eggs could not be secured until July 12, although attempts were made several times previous to this date. In 1921, with a much more advanced season, freshly emerged adults were taken in the field by Mr. Walden, May 29, and the first eggs were obtained July 6 from confined bugs brought to the insectary. Mating takes place from the first of July until October, at least in this locality.

The length of life of the adult in field cages was about one month and a half, but observations on unconfined specimens indicate a longer period—two to two and one-half months or more. Thus in a grass plot near the Station, no spittle balls were seen after the first of July, yet adults were collected here until November 9.

Eggs were laid in small cages, within two or three days after mating.

The adult bug is comparatively sluggish most of the time. It remains on the stems of grass plants, and is not easily disturbed. If poked with a stick it moves leisurely up or down but never rapidly. If it receives a more violent poke or blow it responds with a tremendous hop, landing a foot or more away from the original position. If followed, it will usually be found lying feet upwards on the ground or head downwards in the grass, and a second blow will fail to react on it until it has had time to regain its feet. The bugs are most active towards evening, lying almost inactive during the morning.

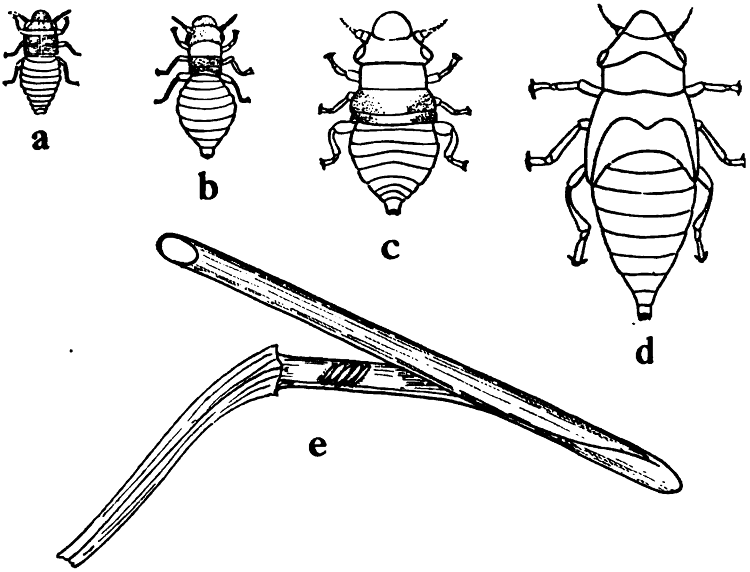


Figure 18. The egg and the nymphal instars of the grass-feeding spittle-bug. a. First instar. b. Second instar. c. Third instar. d. Fourth instar. e. Diagram showing the usual position of the egg.

Description of the Different Stages

Egg (Fig. 18; Pl. XVIII, c.)—The egg is elongate, slightly curved and flattened a little and is usually embedded in a whitish adhesive substance. The surface is smooth. When first laid it is nearly white, but turns light brown with age. There is often a yellowish tint at one end.

Total length about .75-1 mm.

First Instar (Fig. 18, a.)—This stage has the head and thorax and also the legs, dark brown. The abdomen is yellowish white with a darker yellow spot on each side below. The antennae consist of two distinct divisions, the distal division having a number of indistinct annuli. The proximal division has two indefinite segments.

Length of alcoholic specimens 1.2–1.5 mm.

Second Instar (Fig. 18, b.)—This instar is similar in nearly all respects to the first instar except that the prothorax now lacks brown pigment.

The antennae are a little more plainly divided into segments but the two main divisions are still evident. The yellow spots of the abdomen are smaller.

Length of alcoholic specimens 2-3 mm.

Third Instar (Fig. 18, c)—During this stage the abdominal yellow spots disappear, the head loses its brown color, and the wing pads are much more developed. The antennal segments may now be counted with ease.

Length of alcoholic specimens 3.5-4.5 mm.

Fourth Instar (Fig. 18, d)—This stage lacks the brown color of the thorax and head, the entire insect being pale. Antennae are well developed, distinctly segmented and not separated into two divisions as in the first and second instar. The wing pads are well developed, now extending to the caudal margin of the first abdominal segment, and the sexes are easily distinguished with the aid of a microscope.

Length (alcoholic specimens) 5 mm.

Adult, male (Pl. XVIII, b)—Color brown with a pale stripe along each side on the costal margins of the elytra. Head brown, eyes black, the front below marked with arcuate black lines; lora dark brown or black. Venter of thorax and abdomen, and also the tarsal claws black. There is usually a darker stripe on each elytron above the pale costal stripe. The hind legs in common with other spittle-bugs have the tibiae and first two tarsal segments greatly expanded at their tips and spinose.

Length 4.5-5.5 mm; width of head across the eyes 1.5–1.8 mm; greatest width across the elytra when folded 1.8–2 mm.

Female —Similar to the male but slightly larger and the elytra less definitely marked. The meso and metathorax and caudal half of the abdomen below are pale in color.

Length 5-6 mm.

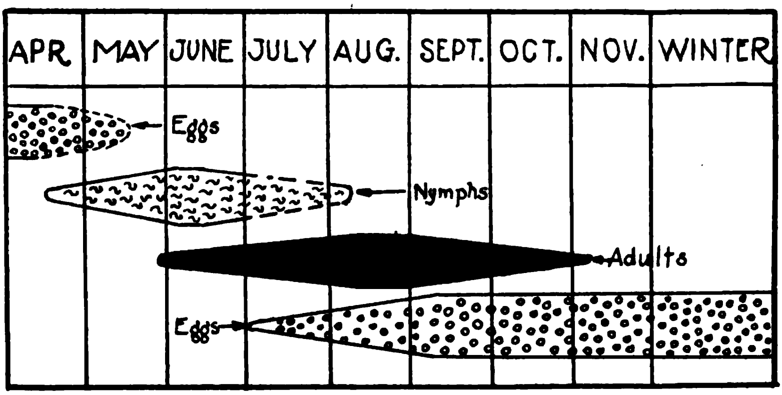


Figure 19. Diagram showing the length of the various stages in the life history.

CONTROL MEASURES

Osborn suggests control measures for the grass-feeding spittle-bugs, which seem ample. Rotation of crops, or burning over grass land in the fall, winter or early spring should be effective. Hopper-dozer control would probably remove many of the adults but the latter are sluggish and it is doubtful whether the method would capture a large per cent. Mowing in spring and fall unless very close to the ground and the grass raked off soon after, would also be ineffective because of the position of the eggs. If the grass is allowed to lie on the ground the nymphs will soon crawl from the cut grass to fresh stems.

Spraying is too costly an operation to be of much use in practical control work. Dusting might be done effectively under some conditions though it is well nigh impossible to get action from any insecticides owing to the protective spittle.

SUMMARY

1. The grass-feeding frog-hopper may cause considerable damage to grasses in meadows.
2. The life cycle lasts a year, the greater part of which is passed as an egg laid during the summer and fall.
3. The eggs are laid between a leaf and a stem, being usually placed 4 or 5 together, and within two or three inches of the ground.
4. The adults are found in the field from June until frost, laying eggs over a considerable period (July-October).
5. The nymph passes through four stages, and lives about a month and a half. Nymphs hatched in 1921 about April 20.
6. Control measures should consist of burning over the land during fall, winter, or early spring.

LITERATURE

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3. Lintner, J. A., 4th Report of N. Y. State Entomologist 1887; p. 240–241.
4. Lintner, J. A., 5th Report of N. Y. State Entomologist 1888; p. 245.
5. Osborn, H., Maine Agr. Exp. Station, Bul. 254; 273–277; 1916.

Note:—This bulletin properly belongs in the report for 1921, but owing to delay in issuing the report for 1920, it is here included to secure its earlier publication.

5

CONNECTICUT

Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 231 SEPTEMBER, 1921

Report of the

Tree Protection Examining Board

By W. E. BRITTON, *Chairman*

Miscellaneous Notes

By E. H. JENKINS

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

October, 1921

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Press of The Wilson H. Lee Company.

FIRST REPORT

OF THE

Tree Protection Examining Board

FOR THE BIENNIAL PERIOD ENDING JUNE 30, 1921.*

By W. E. BRITTON, Chairman.

For many years men have traveled about the State and in various places obtained work for the alleged improvement of orchard and shade trees, such as pruning, spraying, bracing, filling cavities, or applying fertilizers. In some cases good service was rendered and the owners were satisfied; in others no benefit resulted. Occasionally trees were positively injured by the treatment, because the so-called "tree doctors" did not understand their business. Finally this condition existed: tree work was being done by well-trained, intelligent and conscientious men; by poorly trained but reliable men; and worst of all, by unscrupulous men who were usually, though not always, poorly trained. The unsatisfactory work of the unreliable men had a tendency to bring the whole business into disrepute. Some of them were at work here one day, but the next they would be gone, perhaps forever, only to be followed by a new crop. Even though such men guaranteed their work, the owner could obtain no redress because the men could not be found.

More than thirty years ago, in the southwestern corner of the State, traveling "tree doctors" did a flourishing business by boring holes in the trunks of elm trees and inserting some chemical substance which they claimed would dissolve in the sap and be carried to the leaves and keep the trees free from the attacks of the elm leaf beetle. The price was seventy-five cents per tree. It was easy money and many property owners "fell for it." Needless to state, no benefit followed the treatment, and members of the Station staff removed some of the material seven years after it was placed in the tree, and apparently none of it had dissolved. A chemical examination showed it to be powdered sulphur and some kind of grease, two substances as nearly insoluble in the sap as could easily be found.

Now such transient work damaged the business of those men and firms who had established a reputation for intelligence and square dealing, and after due consideration, they thought best to apply for legislation to regulate this condition by the issuing of licenses or certificates to qualified workers.

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* This report properly belongs in the Station report for 1921 rather than in this Station report of 1920. But as there is great delay in issuing the latter it seems advisable to include in it this paper rather than to hold it for the Station report of 1921.

As a result, the following act was passed by the General Assembly of 1919, and was approved May 2nd:—

AN ACT CONCERNING THE IMPROVEMENT, PROTECTION OR PRESERVATION OF FRUIT, SHADE OR ORNAMENTAL TREES.

Chapter 181. Public Acts of 1919. (In effect July 1, 1919.)

SECTION I. No person, firm or corporation shall advertise, solicit or contract to improve the condition of fruit, shade, forest or ornamental trees, by pruning, trimming or filling cavities, or to protect such trees from damage by insects or disease, either by spraying or any other method, without having secured a certificate as specified in section two of this act; and any person, firm or corporation failing to comply with the terms of this act shall be fined not more than one hundred dollars; provided any person may improve or protect any tree on his own premises or on the property of his employer or on any property within the limits of the town of which he is a legal resident, without securing such a certificate.

SEC. 2. The botanist, entomologist and forester of the Connecticut Agricultural Experiment Station shall constitute a board which shall, upon application from any person, firm or corporation, examine the qualifications of the applicant to improve, protect or preserve fruit, shade, ornamental or forest trees, and if satisfied that the applicant is qualified, may issue a certificate so stating; which certificate shall be valid for one year from the date of its issue, unless sooner revoked as provided in section three of this act, and may be renewed by the board for succeeding years without further examination, upon payment of the fee hereinafter required, provided any person, firm or corporation receiving such certificate shall be responsible for the acts of all employees in the performance of such work.

SEC. 3. Said board shall prepare all necessary forms and prescribe all rules and regulations governing examinations, and any certificate issued under the provisions of this act may be revoked by it upon proof that improper methods have been used or for other sufficient cause.

Sec. 4. Each applicant for an examination shall pay a fee of five dollars in advance, and a fee of two dollars, for each certificate or renewal issued; which fees may be expended by the board for any expense incurred by it in making examinations or issuing certificates, and an account of all receipts and expenditures under this act shall be rendered annually to the state comptroller.

As the botanist, entomologist, and forester of this Station were named to constitute a Board, a meeting of this Board was held on June 14th, and organized by electing as Chairman, W. E. Britton, Entomologist, and as Secretary and Treasurer, W. O. Filley, Forester. The Board also drew up the following rules and regulations according to the provisions of the law:—

EXAMINATION RULES AND REGULATIONS.

I. Each person, firm or corporation required to secure a certificate under Chapter 181, Public Acts of 1919, shall be examined as follows: When a firm is under control of one person who is solely responsible for the contracts, methods and oversight of each piece of work, this person alone may be required to pass the examination, but when more than one person is responsible for the methods of work and oversight of same, each shall be required to take the examination. When foremen or others are given complete charge of recommending and applying treatments, they shall also be required to take the examination, in so far as it relates to their work. The Examining Board shall decide who shall be required to take the examination.

II. Unless otherwise arranged, candidates for certificates shall appear for examination at the Connecticut Agricultural Experiment Station, at New Haven, at such times as shall be designated by the Board.

III. Examinations may be oral, written, or both, as shall be determined by the Examining Board, and, in general, shall cover tree species, tree life and growth; diseases and insect pests of trees, with treatment for same; pruning and tree surgery.

IV. Candidates prior to the time of examination shall furnish a typewritten statement of their qualifications as follows:—

1. General education.
2. Special training for tree protection work.
3. Experience in tree protection work. The latter shall include
   (a) Place of business, name of firm and position now held.
   (b) Previous positions held.
   (c) Total length of experience.
   (d) Contracts now under way or completed during the past 12 months.

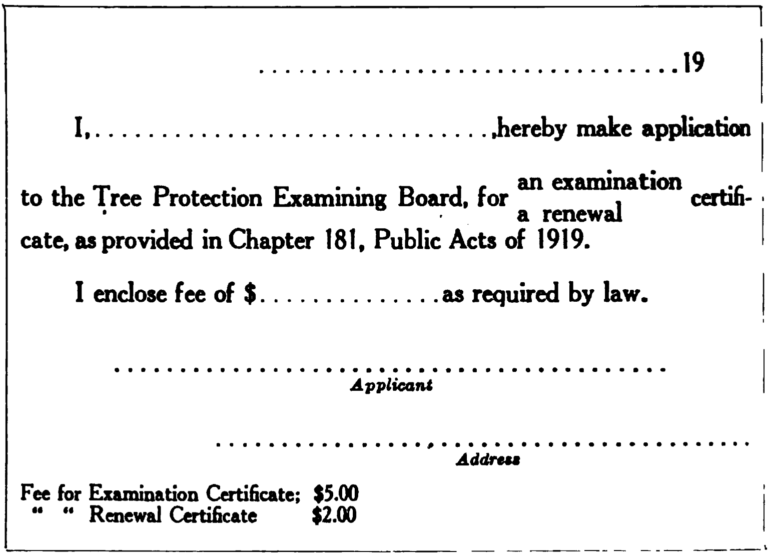
In addition three or more recommendations as to reliability and efficiency shall be furnished; and where typed or printed forms of contracts, regulations, etc., are used, these shall also be supplied, or if not available, statements shall be made concerning the same.

V. If satisfied with the qualifications of the applicant, the Board will issue a certificate good for the succeeding twelve months (unless revoked for cause), then to be renewed upon application under such conditions as the Examining Board may require in each case.

VI. Upon evidence of unfitness in training or improper business methods, the Examining Board may refuse to issue a certificate or cancel one that has been issued. Complaints may be made to the Board on these points, and if deemed desirable by the Board, private hearings of the interested parties shall be held.

The new measure became a law on May 2nd, but it did not take effect until July 1, 1919. In order to give the tree men a chance to meet the provisions of the law, two examinations were held before the law became operative: one on June 27th and one on June 30th. Four examinations were held in July, on the 9th, 12th, 16th and 23rd, respectively.

The form of application used is as follows:—



..............................19

I, ...hereby make application

to the Tree Protection Examining Board, for
an examination
a renewal
certificate, as provided in Chapter 181, Public Acts of 1919.

I enclose fee of $..............as required by law.

....
Applicant

....
Address

Fee for Examination Certificate; $5.00
" " Renewal Certificate $2.00

The law provides that the fee shall be paid in advance. In most cases a check for five dollars was received by mail, but in some cases the applicants were allowed to make payment at the time of the examination.

EXAMINATIONS

The Board expected and preferred to hold examinations rather infrequently and to have each one well attended. But though the new law and notices of the examinations were at first mentioned in the newspapers, only a few candidates were present at most of the examinations. Some of the applicants were unable to be present on any of the dates set and asked for another date in the near future. It often happened that an application would be received a few days following an examination, with a request for an examination at an early date. This explains the reason for holding so many examinations in attempting to accomodate the applicants.

During the two years covered by this report, twenty examinations were held on the dates given below:—

In 1919: June 27 and 30; July 9, 12, 16 and 23; August 1; September 17; October 29; November 19.

In 1920: January 28; March 17 and 31; May 5; June 7 and 17; September 15; December 6.

In 1921: February 28 and May 11.

The examination has consisted of written answers to certain fundamental questions, selected to show the applicants' knowledge of the subject. In addition to these answers, each applicant was asked oral questions by each member of the Board, and he was told whether his answers were right or wrong, and if wrong, wherein they were wrong. Several different sets of written questions have been used in the course of these examinations, and one of these is given below as a sample:—

TREE PROTECTION EXAMINING BOARD.

EXAMINATION QUESTIONS.

(Please indicate by number each question answered.)

A. **Injurious Insects** (Answer *both.*)

(1) Explain the purpose of an insecticide, name examples of the common types, and specify how they are used.
(2) Describe briefly the difference between sucking and chewing insects, explain how each may injure trees and give remedies for each.

(Answer *any two.*)

(3) What are the three principal types of insect injury to trees? Give an example of each with remedy.
(4) How and when would you treat elm trees as a protection against the ravages of the elm leaf beetle?
(5) What are the chief insect pests of the apple orchard, and what treatment is commonly recommended for each?
(6) Give a brief account of the maple borer and how to combat it.

B. **Tree Diseases.** (Answer *three out of the five.*)

(7) What are fungi? Give several examples. How do they reproduce? How does a parasite differ from a saprophyte?
(8) What kinds of injury to trees are caused by the following: Sun scorch? Drought? Ice storms? Late frosts? Lightning? Animals (including man)?
(9) What different fungous diseases have you tried to control and by what methods?
(10) What causes decay of wood in trees and how would you control it?
(11) What is a fungicide? Name four kinds. Give theory of spraying against fungi. How is Bordeaux mixture made? Distinguish between a fungicide and an insecticide.

C. **Tree Surgery.** (Answer *any three.*)

(12) Describe in detail the way you would remove a large limb and the treatment you would give the resulting cut surface if undecayed.
(13) Discuss the relative merits of filled cavities and open cavities, stating under what conditions you would recommend one or the other.
(14) Describe your method of filling cavities, giving the reason for each operation.
(15) What may be done to hasten the healing of wounds and the growing over of filled cavities?
(16) Discuss advantages and disadvantages of the different methods of strengthening weak trees.

D. **Tree Life and Growth.** (Answer *one.*)

(17) Discuss the growth of a tree, indicating where and when growth takes place, also the manner in which the roots and leaves perform their work.

(18) Describe the way in which water and food materials are secured by a tree, and how they are utilized by it.

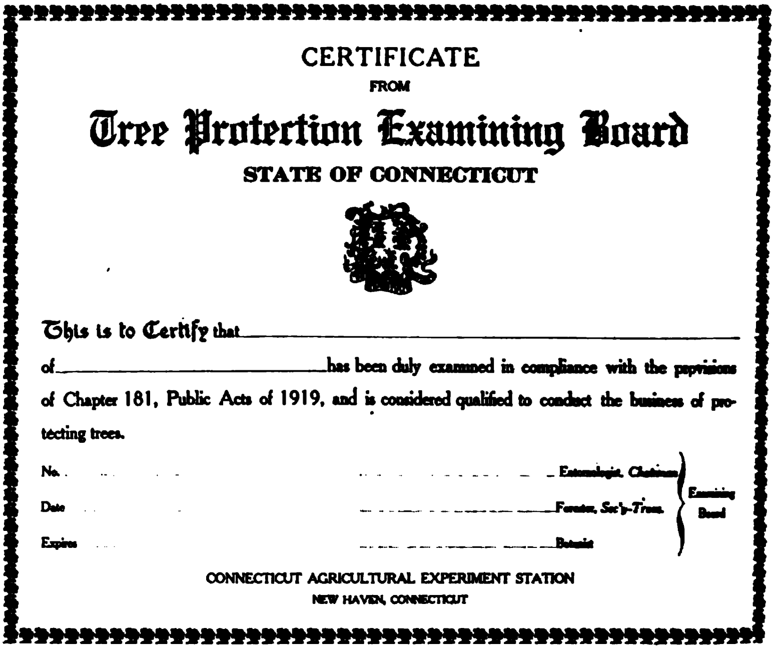
E. **Tree Species.**

(19) Identify the specimens on the table, giving the common name of each as numbered.

Altogether 65 candidates took the examinations. Of this number 61 were finally granted certificates, four of them being required to take a second examination. Four applicants were refused certificates because the Board did not consider them qualified.

CERTIFICATES

The form of the regular certificate adopted by the Board is as follows:—



CERTIFICATE

FROM

Tree Protection Examining Board

STATE OF CONNECTICUT

This is to Certify that ________________________________

of ____________________ has been duly examined in compliance with the provisions of Chapter 181, Public Acts of 1919, and is considered qualified to conduct the business of protecting trees.

No. ________ ________________ Entomologist, Chairman

Date ________ ________________ Forester, Sec'y-Treas.

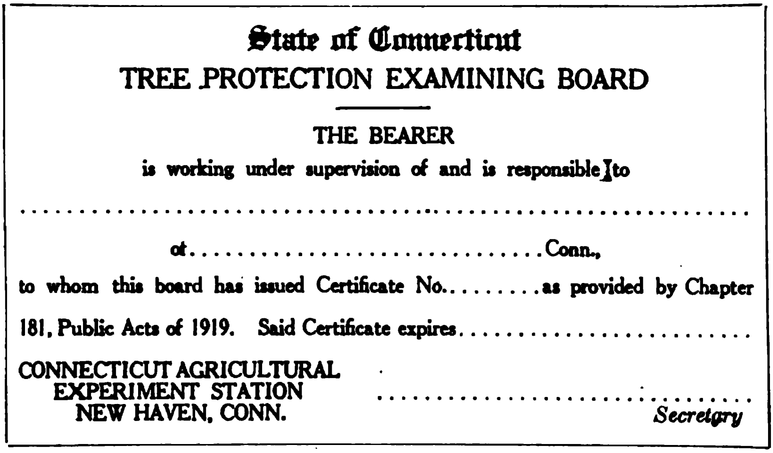
Expires ________ ________________ Botanist

Examining Board

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONNECTICUT

A small card shown below was furnished for each foreman employed by a firm receiving a regular certificate:—



State of Connecticut
TREE PROTECTION EXAMINING BOARD

THE BEARER
is working under supervision of and is responsible to

....

of.................................Conn.,

to whom this board has issued Certificate No.........as provided by Chapter 181, Public Acts of 1919. Said Certificate expires..............................

CONNECTICUT AGRICULTURAL
EXPERIMENT STATION
NEW HAVEN, CONN.

....
Secretary

Up to this time no certificate has been revoked although several holders have failed to renew. The list of individuals and firms receiving certificates between July 1, 1919, and June 30, 1921, together with number and date of each certificate and date of renewal, is given below—

LIST OF FIRMS AND INDIVIDUALS RECEIVING CERTIFICATES FOR TREE WORK.

Biennial Period Ending June 30, 1921.

Name	Address	Certificate Number	Date Issued	Date of Renewal
Armstrong, Edward H.	Branford, Ct.	34	Sept. 18, 1919	Not renewed
Baldwin, Thomas J., Jr.	Guilford, Ct.	21	July 16, 1919	July 15, 1920
Bartlett Co., F. A., (F. A. Bartlett)	Stamford, Ct.	10	July 16, 1919	July 15, 1920
Beaupain & Saunders, (Harry F. Beaupain)	So. Norwalk, Ct.	27	Aug. 13, 1919	Aug. 12, 1920
Bertolf Bros., (August C. Bertolf)	Sound Beach, Ct.	24	July 30, 1919	July 29, 1920
Brown, Edgar M.	Hartford, Ct.	52	June 7, 1920	June 6, 1921
Cardarelli, B. J.	Cromwell, Ct.	57	Mar. 1, 1921	
Clark, Wyllis S.	New Canaan, Ct.	20	July 16, 1919	July 15, 1920
Clyne, G. A.	West Cheshire, Ct.	5	July 2, 1919	July 1, 1920
Condon, Maurice L.	Lake Mahopac, N. Y.	46	Feb. 3, 1920	Feb. 2, 1921
Conn. Forestry Co., (Walter S. Crosby)	West Haven, Ct.	29	Sept. 18, 1919	Sept. 17, 1920
Dept. Pomology, Conn. Agr. College, (S.P. Hollister)	Storrs, Ct.	47	Mar. 22, 1920	Mar. 21, 1921
Davey Tree Expert Co.,	Kent, Ohio			
(Charles T. Burks)	Stamford, Ct.	59	May 27, 1921	
(Geo. J. Champlain)	Kent, Ohio	13	July 16, 1919	July 15, 1920
(Felix H. Caldwell)	Kent, Ohio	15	July 16, 1919	July 15, 1920
(John C. G. DeWolf)	Kent, Ohio	14	July 16, 1919	July 15, 1920
(Peter Gammie)	Kent, Ohio	60	May 27, 1921	
(Walter O. Noyes)	Danbury, Ct.	28	Sept. 18, 1919	Not renewed
(Harold A. Horn)	Kent, Ohio	49	April 5, 1920	Not renewed

Name	Address	Certificate Number	Date Issued	Date of Renewal
Desmond, Thomas H.	Simsbury, Ct.	50	April 5, 1920	April 4, 192
Dunlop, Daniel S.	Cromwell, Ct.	58	March 1, 1921	
Easton, Clifford H.	New York, N. Y.	53	June 17, 1920	June 16, 192
Elm City Nursery Co.,				
(W. E. Campbell)	New Haven, Ct.	7	July 2, 1919	July 1, 192
Gavitt, Lester E.	Westerly, R. I.	51	May 10, 1920	May 9, 192
Gilbert, J. E.	New Haven, Ct.	61	May 27, 1921	
Goodwin Associates, The James L. (Edward E. Pettee)	Hartford, Ct.	38	Nov. 7, 1919	Nov. 6, 192
(James L. Goodwin)	Hartford, Ct.	39	Nov. 7, 1919	Nov. 6, 192
Hartford Forestry Co.,				
(Philip Hansling, Jr.)	Hartford, Ct.	16	July 16, 1919	July 15, 192
(Philip Hansling)	Hartford, Ct.	17	July 16, 1919	July 15, 19
Herthal, Gus, Jr.	Bridgeport, Ct.	36	Sept. 18, 1919	Sept. 17, 19
Herthal, G. F.	Bridgeport, Ct.	25	July 30, 1919	July 29, 19
Homewood Forestry Co.,				
(Peter J. Belletti)	Waterbury, Ct.	41	Nov. 7, 1919	Nov. 6, 192
Hunt Co., W. W.,				
(W. A. Wright)	Hartford, Ct.	33	Sept. 18, 1919	Sept. 17, 192
Jaynes, H. A.,				
Conn. Tree Surgery Co.	Storrs, Ct.	56	Aug. 6, 1920	
Kelley, James J.	New Canaan, Ct.	19	July 16, 1919	July 15, 192
Kellner & Son, Herman H.,	Danbury, Ct.	26	Aug. 13, 1919	Aug. 12, 19
(Arthur H. Kellner)				
Landscape Foresters Ltd.,				
(C. E. Mager)	New York, N. Y.	32	Sept. 18, 1919	Sept. 17, 192
Mallett Co., George A.,				
(George A. Mallett)	Bridgeport, Ct.	11	July 16, 1919	July 15, 192
Markham, W. R.	Middletown, Ct.	23	July 30, 1919	July 29, 192
McLain & Co., J. A.,				
(J. A. McLain)	Stamford, Ct.	37	Sept. 18, 1919	Sept. 17, 192
McLeod, Donald	Cromwell, Ct.	54	June 17, 1920	Not renew
Meader Co., L. H.,				
(Lewis H. Meader, Jr.)	Providence, R. I.	31	Sept. 18, 1919	Sept. 17, 1920
Millane Tree Expert Co.,				
(Neil A. Millane)	Middletown, Ct.	1	July 2, 1919	July 1, 192
Morris, Harry H.	Danbury, Ct.	40	Nov. 7, 1919	Nov. 6, 19
Munson Whitaker Co.,				
(Robert O'Shea)	Boston, Mass.	42	Nov. 26, 1919	Nov. 25, 19
Nichol, James				
(Fred B. Bartlett)	Greenwich, Ct.	12	July 16, 1919	July 15, 19
Old Colony Forestry Co.,				
(Thos. J. McGinnis)	West Haven, Ct.	4	July 2, 1919	July 1, 19
O'Meara, Harry J.	Stamford, Ct.	35	Sept. 18, 1919	Sept. 17, 19
Palmer, Arthur J.	West Haven, Ct.	2	July 2, 1919	July 1, 19
Pauley Tree Expert Co.,				
(George A. Pauley, Jr.)	New Canaan, Ct.	22	July 30, 1919	July 29, 19
Quality Seed Store,				
(William J. Rice)	Stamford, Ct.	9	July 2, 1919	July 1, 19
Rich, Nehemiah L.	Stamford, Ct.	3	July 2, 1919	July 1, 19
Schoonman, W. J.	New London, Ct.	6	July 2, 1919	July 1, 19
Shaw, Walter	Westville, Ct.	55	June 17, 1920	Not rene
Sierman, C. H.	Hartford, Ct.	8	July 2, 1919	July 1, 19
Smith, Joseph P.	Stamford, Ct.	44	Nov. 26, 1919	Not rene
Van Heiningen, Jacob C.	So. Wilton, Ct.	48	April 5, 1920	Not renew
Verkade, H.	New London, Ct.	18	July 16, 1919	July 15, 19
Wilcox, Reginald C.	Essex, Ct.	30	Sept. 18, 1919	Sept. 17, 19
Wright, John L.	Putnam, Ct.	43	Nov. 26, 1919	Nov. 25, 19
Zack, Harry J.	Chester, Ct.	45	Feb. 3, 1920	Feb. 2, 19

TREE WORKERS' INSTITUTE

The early examinations indicated that many of the applicants were not well versed in the growth and care of trees, yet some of these men had conducted a fairly successful business for a number of years. Evidently they knew what to do better than they could tell how or why it should be done. To the members of the Board it seemed unfair to refuse certificates to such men, so an effort was made to help them by giving them the proper instruction in their work; consequently an institute was held at the Station on July 22 and 23, with the following program:-

TUESDAY MORNING, JULY 22

10:00 A. M.	How a Tree Lives and Grows (Illustrated). Prof. A. H. Graves.
11:00	Best Species of Shade Trees for Street and Home Planting. Best Methods of Planting and Guarding Street Trees. G. A. Cromie, Supt. of Trees, City of New Haven.
11:45	Discussion. Led by E. F. Coe, Elm City Nursery Co., New Haven.
12:00	Methods of Fertilizing Trees. Dr. E. H. Jenkins, Director, Conn. Agricultural Experiment Station.

TUESDAY AFTERNOON

2:00 P. M.	Fungous Diseases of Trees. (Illustrated by Stereopticon.) Dr. G. P. Clinton, Botanist.
3:00	Cavity Work and Care of Mutilations. G. A. Cromie, Supt. of Trees, City of New Haven.
3:30	The Pruning and Spraying of Shade Trees. G. H. Hollister, Supt. of Keney Park, Hartford.
4:00	Discussion. Led by F. A. Bartlett, Stamford.
4:15	Question Box.

TUESDAY EVENING

7:30 P. M.	The Tree Doctor and the Golden Rule. Dr. E. H. Jenkins.
8:15	Methods of Forest Planting and Management. (Illustrated by Stereopticon.) W. O. Filley, Forester.
9:00	Discussion. Led by L. F. Harvey, County Agricultural Agent, New Haven.
9:15	Question Box.

WEDNESDAY MORNING, JULY 23

10:00 A. M.	Some Common Insects Attacking Shade and Fruit Trees. (Illustrated by Stereopticon.) Dr. W. E. Britton, Entomologist.
11:00	The Pruning and Spraying of Fruit Trees. (Illustrated by Stereopticon.) E. M. Stoddard, Assistant Botanist.
11:30	Solid Stream Spraying as Practiced in Gipsy Moth Work. (Illustrated by Stereopticon.) I. W. Davis, Assistant Entomologist.
12:00	Discussion. Led by N. A. Millane, Middletown.
12:15	Question Box.

Notices of this institute were sent to newspapers and to all tree workers, including the tree wardens in each town and the men in charge of shade trees in each city in the State. Considering the number of such men interested, the attendance was rather small, about forty being present. The rainy weather no doubt kept many away. The papers were full of interesting information and there was great interest shown by the questions and discussions.

At that time it was planned to hold further institutes but this has not been done, as the need for it has in part at least subsided. It was also thought best to form a State organization of tree workers and a committee was elected to prepare a plan, but so far nothing further has developed.

Financial Statement

Receipts

From 65 examination fees @ $5.00 each		$325.00
53 renewal fees @ $2.00 each		106.00
		$431.00

Expenditures

Printing	$59.70	
Postage	21.26	
Stationery	11.10	
Filing Cabinets, etc.	62.50	
Office Supplies	24.18	
Traveling Expenses of Board	38.28	217.02
Balance on Hand June 30, 1921		$213.98

Dangers Which May Arise

Of course tree workers are supposed to know all about trees and to be able to diagnose troubles on sight. Most of them are unable to do so, and many of our best specialists can do so only after a careful examination. Many times, evidence is lacking. If evidence can be obtained and the tree worker is in doubt, he should submit it to his Agricultural Experiment Station, or to some other institution where competent specialists are employed. There are many cases on record where tree workers have not done this, but induced the owners to allow them to give treatment at considerable expense, which afterward proved useless. Even positive injury has resulted in some instances. It is human nature for the tree worker to dislike to say that he does not know, yet an honest man frequently must do so. It is much better to say so and try to find out, than to make a serious mistake by giving the wrong treatment. There are many injuries to trees which are non-parasitic in their nature, for which the usual remedies for parasitic troubles are worthless.

Then, too, some owners give authority for certain work to be done, but do not keep in close touch with the progress of it and are astounded at the size of the bill when finally presented. A good way of keeping check on the cost is to have the owner or his agent approve and sign the time slips each day or week, as the case may be.

The Board may revoke a certificate for improper work done, or if dishonest business methods are followed when dealing with clients. The Board has no jurisdiction, however, over legal questions, such as fixing damages in a case of violation of contract. Such matters must go to the courts if they cannot be settled to the satisfaction of both parties.

Employ Workers Who Hold Certificates

Unless the owner is acquainted with some tree worker in whom he has confidence, it is safer to employ only those men or firms who hold certificates from this Board. It is true that the law permits a tree worker to practice without a certificate in the town of which he is a legal resident, but this provision was included for the purpose of allowing farmers and orchardists to employ men to do the necessary spraying and pruning of their orchards. It is a question if city tree workers should have been allowed to do this. However, the exception is clear in the law and must stand until changed.

If a tree worker solicits work from you, ask him if he or his firm has passed the examination and holds the certificate of this Board. If not, tell him that you prefer some one who holds a state certificate. This will help to induce all workers to apply for the examination and certificate, according to the provisions of the law. The names of those who have received certificates from the Board are given on pages 345 and 346.

Complaints Will be Investigated

The Board cannot guarantee the work of any one, even though a certificate has been issued to him, but requests that written complaints of unsatisfactory work, discourteous treatment, or improper business methods be filed with the Secretary. So far as may be possible, such complaints will be investigated and the findings will be recorded and furnished to both parties concerned. If the tree worker is at fault and the circumstances warrant, his certificate may be revoked.

The Board also invites complaints regarding tree workers who are operating in violation of the law, and will follow up all such complaints wherever feasible.

A Partial List of Publications Relating to the Care of Trees

Bailey, L. H., "The Pruning Manual," The Macmillan Co., New York, 1919.

Blakeslee, A. F., and Jarvis, C. D., "Trees in Winter," The Macmillan Co., York, 1913.

Collins, J. F., "Tree Surgery," Farmers' Bulletin No. 1178, U. S. Department of Agriculture, Washington, D. C., 1920.

Fernow, B. E., "The Care of Trees," Henry Holt & Co., New York, 1910.

Houser, J. S., "Destructive Insects Affecting Shade and Forest Trees," Bulletin 332, Agricultural Experiment Station, Wooster, Ohio, 1918.

Kotinsky, Jacob, "Insects Injurious to Deciduous Shade Trees and Their Control," Farmers' Bulletin No. 1169, U. S. Department of Agriculture, Washington, D. C., 1921.

Levison, J. J., "Studies of Trees," John Wiley & Sons, New York, 1914.

Peets, Elbert, "Practical Tree Repair," McBride, Nast & Co., New York, 1913.

Rankin, W. F., "Manual of Tree Diseases," The Macmillan Co., New York, 1918.

Solotaroff, William, "Shade Trees in Towns and Cities," John Wiley & Sons, New York, 1911.

Stone, G. E., "Shade Trees, Characteristics, Adaptation, Diseases and Care," Bulletin No. 170, Massachusetts Agricultural Experiment Station, Amherst, Mass., 1916.

Also, the bulletins and reports of this Station, and of other Agricultural Experiment Stations, and of the United States Department of Agriculture, treat of special subjects relating to trees. If available, these may be obtained free on request. It is recommended tha tree workers obtain these publications and use them for reference in connection with their work.

The foregoing report has been approved and adopted as the First Report of the Tree Protection Examining Board. It is intended to issue future reports biennially covering the activities of the Board under the provisions of the law.

Respectfully submitted,

W. E. Britton, Entomologist,
Chairman.

W. O. Filley, Forester,
Secretary and Treasurer.

G. P. Clinton, Botanist.

AN EXPERIMENT IN TOP-DRESSING A RUN-OUT MEADOW

By E. H. Jenkins

The meadow was acquired in 1915. Its previous cropping was unknown but its average annual yield for the following six years was 1.01 tons per acre of poor hay much mixed with weeds. Seventeen plots were established, 14 feet wide and 155½ feet long, each one-twentieth of an acre. Four-foot strips separated the plots. The top-dressings were applied early each year. The hay from all the plots was weighed on the same day. The yields of the checks show an increased natural yield from No. 1 to No. 17, and the "gains" have been corrected as required by this difference in the check plots. For two years no potash could be applied to plot 8, and in 1920 an equivalent amount of muriate was used in place of kainit.

The arrangement of the plots, their treatment and the corrected average results of the six years cropping appear in the following table

Plot No.	Fertilizer	Tons of Hay Per Acre	Corrected Gain in Tons	Cost of Fertilizer 1915	Cost of Fertilizer 1919
1	None	0.80	....	....	....
2	2.3 tons manure	1.57	0.56	$ 8.05	$12.65
3	250 lbs. nitrate	1.98	0.97	6.88	12.50
4	175 lbs. nitrate + 150 lbs. bone	1.74	0.73	7.45	12.65
5	None	0.71	....	....	....
6	250 lbs. nitrate + 200 lbs. acid phosphate	1.96	0.96	8.18	15.85
7	250 lbs. nitrate + 190 lbs. basic slag	2.05	1.04	8.49	*
8	250 lbs. nitrate + 200 lbs. acid phos. + 130 lbs. kainit	2.10	1.10	9.09	*
9	None	0.97	....	......	......
10	Double quantity of 2	1.69	0.68	16.10	25.30
11	" " " 3	2.09	1.08	13.76	25.00
12	" " " 4	1.47	0.46	14.90	25.30
13	None	1.01	....	......	......
14	Double quantity of No. 6	2.44	1.43	16.36	31.70
15	" " " " 7	2.43	1.42	16.98	*
16	" " " " 8	3.19	2.13	18.18	*
17	None	1.10	....	......	......

*Basic slag and kainit were not available in 1919.

CERTIFICATION OF BABCOCK TEST APPARATUS

As provided by statute the Station tests the accuracy of Babcock apparatus which is used for determining the value of milk or cream. Each piece thus tested is permanently marked with the Station initials, CT. AG. ST. if it is accurately graduated: BAD if it is inaccurate.

Since our last report 2,102 pieces have been tested of which 43, or about two percent, were bad.

SORGHUM JUICE

A single test of juice from Early Amber Sorghum grown at Mt. Carmel gave the following result:

Sucrose (Cane sugar)	7.35%
Invert sugar	3.29
Total sugars	10.64
Undetermined solids	1.87
Total solids	12.51

TEST OF PERILLA

Perilla frutescens is grown extensively in Japan for the oil in its seeds. In 1917 the Institute of Industrial Research asked the co-operation of this Station in testing its growth in this part of the country.

The seed was planted in drills 18 inches apart about 3 inches apart in the row.

The planting was made May 31st, as weather and labor conditions made earlier planting impossible.

On September 18th, the plants had a maximum height of 50 inches, average 44-46 inches, and were beginning to blossom.

They were sparsely branched mostly near the root, and had already been slightly touched by frost. A short time later they were killed by cold.

We judge that, in this region, seed could only be produced by starting the plants in the greenhouse and later setting them in the field.

EFFECTS OF BORAX ON THE GROWTH OF POTATOES, CORN AND BEANS

By E. H. Jenkins

In consequence of the lack of German potash salts during the war, various domestic sources of potash were exploited and their output eagerly sought and used.

Occasional injury or total loss of crops led to careful search for the cause, which in widely separated districts was not at first evident. It was found that the domestic potash obtained from certain sources contained notable quantities of borax, which in relatively small amounts is a plant poison, and it was proved that in some cases the injuries noted were certainly caused by borax in the fertilizer. Further study of the poisonous effect of borax and the limits of its toxicity seemed to the directors of the New England, New York and New Jersey Stations to be immediately necessary, and it was evident that such a study could be carried out best as a single joint project, each Station bearing its proportionate part of the expense involved. This Station joined with the others in this study.

Director Hills of the Vermont Station placed a suitable greenhouse at the disposal of the co-operating Stations, Director Woods and Dr. Morse, pathologist of the Maine Station, assembled the materials and prepared detailed plans, Director Lipman of the New Jersey Station selected a trained experimenter to take charge of the greenhouse work, and the experiments were carried out during 1920. The method and results were published in Soil Science Vol. XII, No. 2, pp 79-106, 13 plates August 1921, with the title, "Effect Upon the Growth of Potatoes, Corn and Beans Resulting from the Addition of Borax to the Fertilizers Used. J. P. Neller and W. J. Morse."

The general summary is as follows:

"Plants were uninjured where fertilizer mixtures made from borax-free chemicals were applied to soil in pots in which potatoes, corn and beans were grown. These crops were injured where the pots contained the same soil and the same fertilizer mixtures in like quantity, provided sufficient amounts of borax were added with the fertilizer. The same types of injury were produced, in somewhat greater degree, when a commercial fertilizer carrying equivalent amounts of borax was applied.

"Corn and beans were more susceptible to the injurious effects of borax than were potatoes. Under the conditions of the experiment, anhydrous borax at the rate of 3 pounds per acre was the largest amount that could be applied in drills with safety to beans. The limit for corn is somewhat under 5 pounds, and for potatoes slightly above 5 pounds per acre. Borax applied with the fertilizer below the seed or seedpiece proved more toxic in all cases than where applied above in like manner. Mixing the borax and fertilizer with the soil decreased the injury and slightly raised the amount that could be applied per acre with safety.

"Evidence was obtained that applications of lime prevented some of the injury to potatoes. The tests with gypsum and manure were not conclusive with this crop. All three of these materials seemed to reduce the toxic effects on corn. Lime was beneficial with beans, but gypsum and manure did not show any appreciable influence.

"The above results were all obtained with soil at an optimum water content of 19.2 per cent. A subsequent test with beans showed that more injury occurred where the soil moisture was maintained at 15.2 per cent. than where it was 30.4 per cent.

"The only indication of possible stimulation due to the presence of small amounts of boron occurred with corn, but the evidence was inconclusive."

The Station has a few reprints of this paper which can be given to persons specially interested in the technique followed.

TIMOTHY AS A COVER CROP FOR TOBACCO LAND

By E. H. Jenkins

Various experimenters have made observations on the amount of vegetable matter and plant food left in the soil by the stubble and roots of crops. Among these may be cited:

Heiden, Düngelehre, I, p. 72, 1866, and III, p. 243, 1872, notes the work of Boussingault, John, Schubart, Hellriegel, Dietrich and others.

Hopkins, Soil Fertility and Permanent Agriculture p. 218, 1910, gives statistics on the amount of dry matter and plant food in various legumes and cites the observations of others.

Penny, Delaware Station, Bulletin 67, 1905, reports observations on the root system of crimson clover at various periods of growth.

In the report of the Connecticut Board of Agriculture, 1871, p. 95, notice is given of Weiske's observations at Proskau, on the composition of roots and stubble of a number of crops. (Versuchs-St. 14, p. 107, 1871.)

Woods, Storrs Station Report, 1888, p. 28, reports Observations on the Quantity and Composition of Roots of Clover, Timothy, Wheat and Other Plants, taken at time of harvest in Maine.

The observations here to be noted do not admit of close comparison with those referred to above, for these reasons: They were made on young, green crops to be plowed under for manure. The sowing was somewhat heavier than would be practiced if the crop were to be harvested and it was grown on tobacco land, and therefore on very heavily fertilized soil.

The observations specially concern or only concern tobacco growers.

It is matter of common knowledge and common complaint among tobacco growers in the Connecticut valley that on many fields the yield of tobacco has gradually decreased.

No appreciable loss of quality in the leaf is noted but only an unsatisfactory yield per acre.

This cannot be attributed to lack of fertilizer for increased applications and changes in the fertilizer formulas have not improved this condition.

The cause of the trouble is not known and can only be surmised, but it has been noticed in some cases that resting the land by growing other crops for a few years restored the soil, so that the yield of tobacco became satisfactory again.

But this change of crops is both inconvenient and expensive. The tobacco grower usually specializes in the one crop.

His barns, tools and help cannot conveniently be shifted to the raising of other crops at any profit.

This condition has raised the question whether the restoration of the land cannot be effected gradually, if not immediately, by growing some kind of cover crop between successive tobacco crops, sowing the seed as soon as possible after harvesting tobacco and keeping the cover crop on the land until it has to be broken up in the spring and fitted for the next crop.

Several well-known growers have followed this plan consistently for a number of years and have obtained very favorable results, some of which are reported in the Hartford County Farm News for August, 1919.

Various cover crops have been suggested and tried. The nitrogen-gathering crops, vetches, clovers, soy beans and the like have no special value over the cereals on tobacco lands, because they do not exercise their nitrogen-gathering function where nitrogen is fairly abundant in the soil already, as is the case on highly fertilized tobacco fields.

There is the further objection to their use that certain legumes are natural hosts of the dreaded *Thielavia* or root rot disease; moreover they make no such growth through the colder season as do the cereals and other grasses.

Of these rye has been and is, quite commonly used. The tradition that it sours the land has no basis in fact, but one sound objection to it is its very rapid growth in spring. If it is not turned under at just the right time it becomes too "woody" and when turned under decays but slowly and leaves the soil too loose and open. If rye is used it should be sown at the rate of a bushel and a half to the acre.

50

Timothy is now being tried and so far has given good satisfaction. It makes slow growth above ground and never gets too rank or woody before the time for plowing, but it forms a thick mat of very fine roots which fill the soil to the depth of six or eight inches and takes up from it surprisingly large amounts of plant food. It can be sown thicker than is usual in seeding down for a hay crop. Half a bushel of timothy seed per acre should be enough. It should be sown as early as is possible. Where tobacco is primed the seed may be sown after the second priming. Some wait until the tobacco is harvested and the stalk disk-harrowed.

We urge tobacco growers who are concerned with diminishing yields on their fields to test timothy as a cover crop for at least three years in succession, sowing early, with a fairly heavy seeding. It is the only alternative in sight to avoid the necessity of dropping tobacco and growing other crops for a time; and the experience of some growers has shown its value in restoring production.

Apart from the use of cover crops as a corrective for failing tobacco soils, they are always needed as a protection from the drifting of the soils in high winds, from their washing in heavy rains and from the leaching of the plant food in them. Whenever the land is unfrozen, timothy and rye are always growing and gathering and holding the soluble plant food in the soil for the following crop and adding to it a store of organic material got largely from the air.

Within the last two years some observations have been made by Mr. B. G. Southwick, the Hartford County Agent, Mr. Henry Dorsey, Extension Agronomist, and the writer, to determine how much organic matter and plant food a timothy cover crop might gather from a tobacco soil and hold for the tobacco crop.

The samples, usually five in each field, were taken with a six inch iron tube, driven down six or seven inches. The cores thus obtained with the roots and top growth, were very carefully washed out by the writer, on fine sieves, and when partially dried were cleaned as far as possible of all adhering soil and foreign matters and then analyzed.

While some roots go much deeper than seven inches their total weight is relatively very small.

The averages of the five samples taken from each field are given below.

A., B. and C. were taken May 8, 1919, just before the crop was turned under. The top growth was six to eight inches high. A from land of D. E. Newberry, South Windsor, B from Windsor Tobacco Corporation, Windsor, C from S. F. Brown, Poquonock.

D. E. F. were taken in the late fall of 1919 and show what had been taken by the crop before winter. D from J. W. Alsop, Avon, E from J. E. Phelps, Suffield F from D. E. Newberry, South Windsor.

G. and H. were taken in May, 1920, just before plowing. H is a mixture of timothy and alsike clover. In 1920 timothy did not make nearly as good a growth as in the previous year on account of unfavorable weather conditions and farmers generally did not have as good cover crops as usual.

The samples were taken from different fields, probably unlike in soil, moisture conditions and fertility, so that no very close agreement in results was to be expected.

But in general they indicate that *an even, thick stand of timothy may contain, when plowed under, not far from three tons of vegetable matter, 100 pounds of nitrogen, 50 of phosphoric acid and more than 100 pounds of potash for the use of the following crop.*

To fix a valuation on this material is hardly possible.

If we calculate that forty per cent. of the nitrogen is available to the coming crop and half of the phosphoric acid and potash, we find a valuation of about $31.00.

But the value of three tons of vegetable matter, quite widely and evenly distributed in the soil it is impossible to estimate.

Pounds Per Acre of Organic Matter and Plant Food Contained In a Cover Crop of Timothy Grown on Tobacco Soil

Spring, 1919	Organic Matter.	Nitrogen.	Phosphoric Acid.	Potash.
A. So. Windsor,	7860	176	70	173
B. Windsor,	6099	185	75	183
C. Poquonock,	7112	160	72	150
Average	7020	173	72	168
Fall, 1919				
D. Avon	2813	68.2	31.5	61.2
E. Suffield,	2015	60.2	28.2	49.2
F. So. Windsor,	1398	39.4	17.8	28.3
Average	2075	55.9	25.8	46.2
Spring, 1920				
G. Suffield,	5060	94.8	37.8	117.0
H. So. Windsor,	6693	90.4	57.6	131.5

ERRATA.

Page 8, Last line, for Unbleached read Unleached.
12, Eighth line, for Foul read Fowl.
20, Fourth line from bottom, for Roger read Rogers.
40, Second line in table, for M. S. Shoemaker, read M. L. Shoemaker.
42, Sample 15031, for North, read Northern.
59, Second line following table, for potato, read pot.
142, 143, Top of 3rd column, for average, read acreage.
225, Twenty-third and twenty-ninth lines from top for glycerrizin read glycyrrhizin.
231, Tenth line from top, for cellusoses read celluloses.
282, Seventh line from bottom for adopted, read adapted.

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State of Connecticut

PUBLIC DOCUMENT No. 34.

BIENNIAL REPORT

CONTAINING THE THIRTIETH AND
THIRTY-FIRST ANNUAL REPORTS

50

OF THE

STORRS
Agricultural Experiment Station

STORRS, CONNECTICUT

FOR THE YEARS 1917-1918, 1918-1919

Printed by the Order of the General Assembly.

PUBLICATION

APPROVED BY

THE BOARD OF CONTROL.

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(*As of June* 30, 1919.)

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REPORT OF THE TREASURER.

For the Fiscal Years ending, June 30, 1918, and June 30, 1919. The following summary of receipts and expenditures, made in accordance with the form recommended by the United States Department of Agriculture, includes, first, the federal appropriation of $7,500 known as the Adams Fund, second, the federal appropriation of $7,500 known as the Hatch Fund, and third, the State appropriation and miscellaneous income.

RECEIPTS	ADAMS FUND		HATCH FUND		STATE & MISC.	
	'17-'18	'18-'19	'17-'18	'18-'19	'17-'18	'18-'19
U. S. Treasury	7500.00	7500.00	7500.00	7500.00		
State of Conn.					7500.00	7500.00
Misc. Receipts					8523.08	15258.14
					16023.08	22758.14
EXPENSES						
Salaries	5714.07	5655.95	6867.34	6107.02	808.27	2813.47
Labor	889.19	1046.88	243.56	1057.44	5372.23	9187.18
Postage & Stationery	1.16	24.86	38.41	20.80	292.93	453.56
Freight and Express	13.52	.86		12.97	204.81	134.04
Heat, Light Water and Power	1.65		.93	.50	1.40	100.00
Chemical Supplies	73.21	112.52	34.41		281.65	45:30
Seeds, Plants and Supplies	45.25	63.89	158.67	155.83	263.04	601.66
Fertilizers		3.50	23.00		928.55	1261.28
Feeding Stuffs	481.33	241.25	14.54	22.50	2162.71	912.73
Library			20.02		12.76	14.50
Tools, Implements & Machinery	2.06	.90	57.80	55.80	352.69	304.99
Furniture & Fixtures				4.50	18.80	526.00
Scientific Apparatus	9.71		5.50		24.65	46.25
Live Stock	188.62	138.67				281.00
Traveling Expenses	80.23	210.72		42.64	1806.25	622.34
Contingent Expenses					22.11	897.80
Buildings and Land				20.00	109.48	521.55
Publications			35.82		93.06	
Balance					3267.69	4034.49
	7500.00	7500.00	7500.00	7500.00	16023.08	22758.14

All of the foregoing accounts have been audited by the auditors of the College and found correct.

REPORT OF THE DIRECTOR.

To the Board of Trustees of the Connecticut Agricultural College.

Gentlemen:

I herewith submit a report of the work of this Station for the two years ending September 30, 1919.

The last report made by me is for the biennial period which closed September 30, 1917. Owing to great delay in preparing and printing the bulletins, there were contained in that report all bulletins, including No. 99, which were issued up to August 1918 or almost a year after the biennial period closed.

This made that report of unusual size exceeding the number of pages provided by statutes and correspondingly decreases the number of bulletins included in the present report.

The more important results of our work during the present biennial period are here very briefly summarized.

The study of the infectious abortion of cows has shown that the calves of infected cows always give at birth the characteristic reactions for the disease but invariably lose it in from three to ten months indicating that they do not receive from their mothers the active agent of the disease. The disease, therefore, is not inherited.

Heifers and young cows are more susceptible to the disease than older animals.

The work thus far points to the bull as the most common means of spreading the disease, carrying it from one animal to another during service and animals then infected in most cases remain positive by the blood test. A bulletin, No. 103 has been issued giving full directions for treatment of the bull so as to prevent this source of infection.

Thus far attempts to infect heifers thru the channel of the digestive tract have met with negative results.

The work on white diarrhea of fowls has shown that adult fowls as well as young chicks are subject to permanent infection and this is probably a chief obstacle to rapid and complete eradication of the disease from the flock. Laying hens are readily infected if the organism of the disease is introduced into the cloaca and while the agency of the male has not been definitely proved, the evidence points strongly to this source of infection. The probability of infection of the oviduct in other ways appears remote.

The results of studies in the variations of fat and solids in milk based on 7½ years' observations of Jerseys, Guernseys, Ayrshires and Holsteins have been published. The average percentage of fat and solids not fat, with maximum and minimum figures for each breed are given. (Bulletin No. 94). Mature cows gave lower percentages of fat and solids than young cows.

Cows in good condition show the highest percentages of fat and solids at calving time which decline to their lowest point in lactation in from 20 to 30 days. Percentages of fat and solids were lower in summer than in winter.

In the calendar year 1915, the per cent of fat in the milk of the different breeds fell below the legal standard of 3.25 per cent, during five months for Holsteins, two months for Ayrshires and one month for Jerseys and the mixed milk of the whole herd for three months.

Studies in processing milk have shown that "clarification" of both raw and pasteurized milk makes an apparent increase in the bacteria count with a very slight reduction in the cream line. Vat and in-bottle pasteurization were equally effective, both making very little difference in the cream line. But vat pasteurization requires less time, cooling and equipment.

Pumping and bottling greatly contaminate the milk if the apparatus is not rigidly cleaned. Properly flushing of the apparatus with chloride of lime before use prevents recontamination of the milk.

Experiments in feeding calves with silage and with whole milk dilutions indicate no gain in feeding calves silage until they are two months old, and perhaps it is better to withhold it until they are three months old. In the 2nd and 3rd months two pounds may be fed with skim milk or diluted whole milk. In 3rd month 1½ lbs., 4th month 4 lbs., 4th and 5th month 6 lbs. and then increase to 8 lbs.

A 25% dilution of Jersey milk raised calves nearly equal to first-rate skimmilk calves and produced better gains and better looking calves than milk substitute rations. Such calves took 700-800 lbs. of whole milk and made gains at lower cost per pound than when fed milk substitutes.

Studies of cattle lice have determined their life histories, have shown the bad effect of lice on the growth of calves, that the lice are most prevalent in winter and the effectiveness of raw linseed oil as a preventive and cure if applied when the animals are brought from pasture in the fall, and according to the method described in Bulletin 97.

A study of criteria for the selection of laying hens has shown that laying activity causes a loss of yellow pigment from the ear lobes, vent, and beak, and to a less extent from the legs of fowls which returns on cessation of laying. Taking measurements of coloration has been used very successfully in separating high from low egg producers.

A study of factors in incubation develop the following facts. After eggs have been kept more than five days before incubating the percentage which will hatch begins to decline. The best temperature for incubation is 102°-103°.

The ventilation provided in the commercial incubators is perfectly satisfactory if they are run as directed. The latitude in the amount of carbonic acid in the incubator to give satisfactory results has been determined and shown to be quite large.

The latitude of moisture content in the air of incubators which is consistent with successful incubation has also been determined by careful experiment and is also large. Extensive tests have proved that any cooling of the eggs during incubation is profitless. Two turnings of the incubating eggs per day are shown to be all that is generally profitable. The Bulletin (No. 95) summarizes the work with practical directions for management of laying hens and their eggs. A study has been made of the normal rate of growth of White Leghorns.

Bulletin 104 is a bacteriological study showing the value of milk and milk cultures of certain bacteria in changing the nature of the intestinal bacterial flora and thus greatly diminishing intestinal putrefaction and resulting in auto-intoxication.

Much valuable work has been done in the agronomy department which has now reached a point where conclusions may be safely drawn from continued field experiments and these will soon be ready for study and publication.

The zoology department is now making a careful study of the parasites which greatly damage the sheep industry, especially of the so called stomach worm.

Respectfully submitted,
E. H. Jenkins, *Director.*

STORRS

Agricultural Experiment Station

STORRS, CONNECTICUT

BULLETIN 100, JANUARY, 1919

EGG LAYING CONTESTS

Part I

Sixth Annual International Egg Laying Contest.

Part II

Report of the Seventh Competition and Some Five-Year Averages.

LESLIE E. CARD WM. F. KIRKPATRICK

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PART I.

INTRODUCTION.

As the laying contests at Storrs continue there accumulates in the files of the poultry department a vast amount of data relative to the birds involved. The daily egg production of each individual bird is recorded and also her body weight taken at intervals of two months thruout the year. On the basis of the pen as a unit are kept various other records such as the daily weight of eggs, the weekly or monthly weight of mash, grain, grit, charcoal, and oyster shell consumed and the daily, weekly and monthly egg production. All these data on several thousand birds offer an almost limitless field for statistical research.

In reporting the several contests the authors have endeavored to present the practical application of some of the information brought out by a study of the records. In previous years there has been relatively little difference between successive contests in the matters of feed cost per hundred pounds and value of eggs per dozen. The variations have had to do more with the number of eggs produced and the influence of this factor on the quantity of food consumed and on the gross income. In contrast to this condition, the sixth contest here reported has included the problem of higher feed costs and also higher egg values. It is fortunate, in a way, that the average egg production of all birds in the sixth contest was only slightly more than one egg higher than the average for the fifth competition. By reason of this fact we have a fair basis of comparison with respect to cost of feed and value of eggs during the two years.

GENERAL CONSIDERATIONS.

In some respects the sixth contest exceeded all its predecessors. A pen of Barred Plymouth Rocks entered by Fairfields Poultry Farms of Short Falls, N. H., made a new high weekly record by laying sixty-seven eggs in the seven days beginning May 23, 1917. This is at the rate of 95.7 per cent and approaches continuous laying about as closely as can reasonably be expected. If, however, one arbitrarily selected a week beginning one day earlier, this same pen laid sixty-nine eggs in seven consecutive days or a production of 98.6 per cent. This pen of Plymouth Rocks also carried off first honors for the year by laying 2119 eggs in the fifty-two week period.

The winning individual for the year was also a Barred Plymouth Rock and was entered by Merrit M. Clark of Brookfield Center, Conn. This hen laid 277 eggs during the contest year. A photograph of the bird and a facsimile of her daily egg record are reproduced on another page.

The question has been raised as to whether pens whose owners have entered birds in previous contests make higher records than do those pens whose owners are sending birds for the first time. Table 1 answers this question by showing, for each breed and for all breeds combined, the average egg production of pens whose owners were entering birds for the first, second, third or fourth time. The last column gives, for the purpose of easy comparison, the average pen production for all birds in each breed. In tabulating this material no account was taken of birds sent to the first two contests when only five birds were required for entry. The number of pens included in some of the groups is small and for this reason the authors do not feel warranted in drawing any final conclusions. The table as it stands, however, indicates a balance quite strongly in favor of the old contestants. Whether this difference is due to breeding from trap-nested birds returned from earlier contests, to the development of more skill on the part of the breeder in the selection of pullets to make up the competing pen, or to a natural tendency for the owner to give his growing pullets better care because some of them are going to the contest, is of course impossible to determine.

TABLE 1.

AVERAGE EGG PRODUCTION, IN THE SIXTH CONTEST, OF PENS WHOSE OWNERS WERE ENTERING BIRDS FOR THE 1st, 2nd, 3rd or 4th TIME.

Breed	1st Time	2nd Time	3rd Time	4th Time	Av. for the Breed
Plymouth Rocks	1561 (5)	1776 (5)	1424 (1)	1476 (3)	1610 (14)
Wyandottes	1664 (9)	1579 (6)	(0)	1728 (3)	1652 (18)
R. I. Reds	1516 (5)	1589 (5)	1674 (6)	1536 (5)	1583 (21)
Leghorns	1691 (19)	1589 (10)	1665 (4)	1736 (10)	1676 (43)
Miscellaneous	1367 (3)	(0)	1745 (1)	(0)	1461 (4)
All Breeds	1624 (41)	1627 (26)	1656 (12)	1650 (21)	1634 (100)

Figures in parenthesis refer to the number of pens involved in each case.

MORTALITY.

In the accompanying table are shown the number of birds that died each month during the year together with the chief causes of death. The total mortality for the 1000 birds amounted to 120 individuals or twelve per cent. This compares very favorably with the mortality in previous years. Except for nineteen deaths from heat prostration, sixteen of which occurred on one day in July, the mortality would be lower than normal. Colds and canker caused twelve deaths during the year, twelve more were caused by internal hemorrhage, liver trouble accounted for eighteen, and sixteen individuals died as

TABLE 2.

MORTALITY 1916-17

Number and Causes of Deaths each Month

MONTH	Accidental	Heat Prostration	Colds and Canker	Internal Hemorrhage	Liver and Spleen	Worms	Prolapsus of Oviduct	Egg Yolks in Body Cavity	Intestinal Disorders	Paralysis	Tumors	Doubtful	Miscellaneous	Total
November			3	1	1		1					1		7
December			2											2
January			1		3	1		3			2	1		11
February			1			1		1		1	2	1	1	8
March	1		2	1		1		2						7
April				2	1		1				1			5
May			1	2	2		3					1		9
June				1	3	1		3	1		1	1		11
July	3	16	1	2	1	1					1		1	26
August		3	1	1	2	2		5				2		16
September				1			1	2		1	1	1	1	8
October	1			1	5	1		1		1				10
Year	5	19	12	12	18	8	6	17	1	3	8	8	3	120

Barred Plymouth Rocks, Record 2119 Eggs.

a result of egg yolks being deposited in the body cavity. As would naturally be supposed the deaths were not evenly distributed thruout the 100 pens. There were forty-one pens in which no deaths occurred and there were seven pens which lost four or more individuals during the year. Distributed by breeds the mortality figures are as follows: Plymouth Rocks 12, Wyandottes 24, Rhode Island Reeds 20, White Leghorns 58, and 6 in the miscellaneous group.

White Wyandottes, Record 1855 Eggs.

Rhode Island Reds, Record 1990 Eggs.

SHOW ROOM SCORES.

As in the two previous contests all birds were judged from the show room point of view at the beginning of the contest year. This, of course, meant that a few pens which did not arrive until late missed the opportunity of being scored. In computing the average pen score for the different breeds, only those pens which were actually on the plant and were judged have been considered. The following is a brief summary of the results on each of four principal breeds. In computing this table Barred, White, and Buff Plymouth Rocks have been considered together, as have White and Buff Wyandottes. The pen scores are presented on the basis of 1000 for perfect, because ten hens in a pen, each making a perfect score of 100, make a total possible score of 1000 points.

Breed	No. Birds	No. Disqualified	Best Pen Score	Average Pen Score
Plymouth Rocks	140	5	932	884
Wyandottes	180	16	919	912
R. I. Reds	210	22	912	889
White Leghorns	430	14	930	872

White Leghorns, Record 2090 Eggs.

As compared to the scores of the previous year, Plymouth Rocks and Wyandottes were better show birds, considering the breeds as a whole. With Rhode Island Reds and White Leghorns the average pen scores were lower than in the preceding competition, but the best pen in each of these breeds exceeded by several points the best pen in the 1915-16 group.

In the matter of individual scores, improvement was shown over the previous year in the case of White Plymouth Rocks, White Wyandottes, Buff Wyandottes, and Rhode Island Reds; while in other varieties the best individual was no better and in some cases scored slightly below her predecessor.

Barred Rock	**90**	**White Wyandotte**	**93½**	**White Orpington**	**93¼**
White Rock	**93¾**	**Buff Wyandotte**	**92**	**White Leghorn**..	**94**
Buff Rock	**92**	**Rhode Island Red**	**93¼**	**Silver Campine**..	**90¾**

Buff Wyandottes, Record 1936 Eggs.

WEIGHT AND VALUE OF EGGS.

Table 3 following shows the total number of eggs produced by each of the principal breeds, their total value and the average value per dozen. As in previous contests, the Wyandottes hold first place from the standpoint of average value of eggs produced. They have outlaid the other breeds during four months of relatively high prices, i. e., December, January, September and October. The advantage gained here has been sufficient to overcome considerable leads in the matter of production made by other breeds during the remaining eight months. As in previous reports, the factor of size was not considered in determining the values given per dozen eggs. All eggs which weighed over one and one-third ounces were considered marketable at current prices. All calculations of egg values have been based on a monthly price, this in turn being obtained by averaging the weekly prices to the nearest half-cent.

Buy egg cases during the fall and winter when they are easily obtained and relatively cheap.

The average value of all eggs produced was 46.1 cents per dozen as compared to 34.5 cents for the previous year. The total value of all eggs produced per bird was $6.28 as compared to $4.66 for the preceding contest. With this increase in gross income of $1.62 per bird it is evident that a fairly large increase in production costs could occur without reducing the net income per bird or per dozen eggs. With the conditions under which the contest is operated, that is, with the 1000 birds housed in one hundred pens and with the extra labor involved in keeping the egg and feed records, it can hardly be expected that the income from 1000 hens will pay for feed, labor, supplies, printing costs, stenographic assistance, to say nothing of interest and depreciation, and still leave a profit. The only cost which can be charged against the birds with reasonable assurance that it would not materially change in a commercial flock making the same average production, is the feed cost. For this reason the data are discussed from the standpoint of "Return Above Feed Cost" rather than from the idea of profit. The authors realize that the production of 168 eggs per hen is considerably higher than the average commercial poultryman is likely to obtain. Under commercial management it would

TABLE 3.

VALUE OF EGGS PER DOZEN

(Based on total number of eggs and total value.)

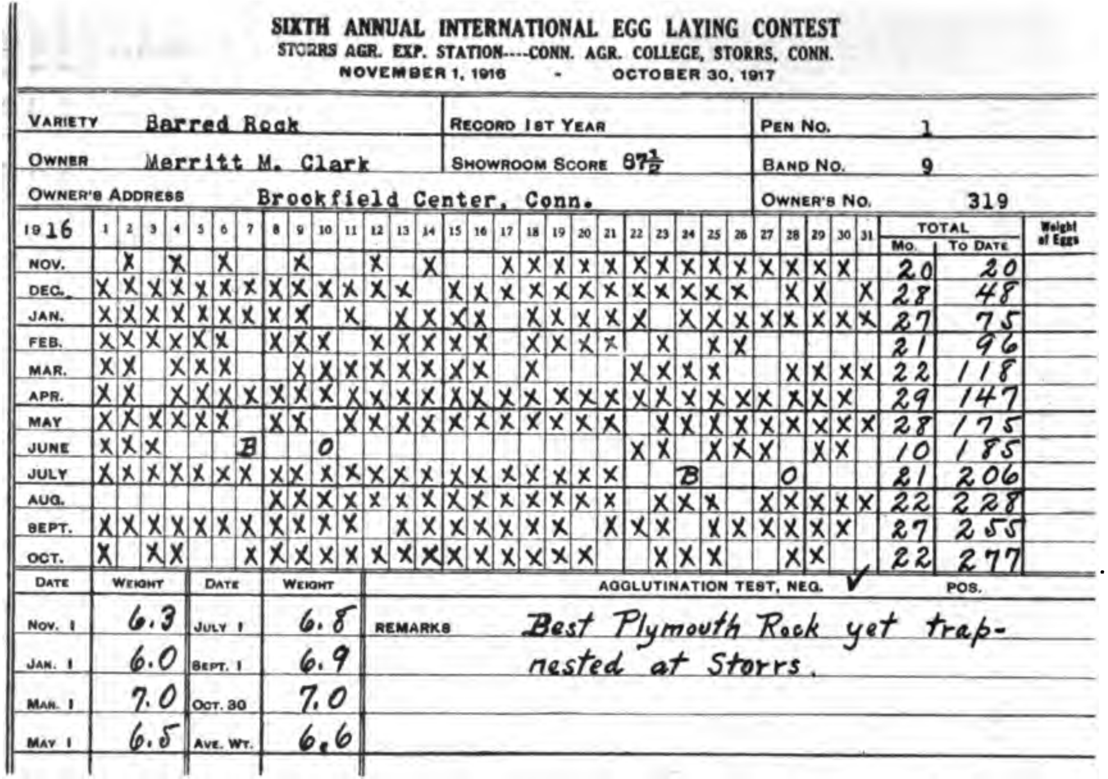
Breed	Number of Birds	Eggs per Bird	Total Number of Eggs	Total Value	Value per Dozen
Plymouth Rocks	140	161.0	22,542	$ 864.05	46.0¢
Wyandottes	180	165.2	29,745	1158.27	46.7¢
R. I. Reds	210	158.3	33,250	1282.84	46.3¢
White Leghorns	430	167.5	72,044	2745.22	45.7¢
Miscellaneous	40	146.1	5,845	226.66	46.5¢
All Breeds	1000	163.4	163,426	$6277.04	46.1¢

TABLE 4.

VALUE OF EGGS BY MONTHS

Month	Eggs	Price per Dozen*	Value
November	5593	64.5¢	$300.65
December	8231	61.5	421.86
January	9313	52.5	407.44
February	12319	47.0	482.54
March	18424	37.5	575.75
April	18543	37.0	571.65
May	17965	38.0	569.00
June	18749	38.0	593.80
July	17154	42.5	607.57
August	14995	51.5	643.59
September	13737	56 0	641.04
October	8403	66.0	462.15
Year	163426	46.1¢	$6277.04

* Averaged to the nearest half cent.



SIXTH ANNUAL INTERNATIONAL EGG LAYING CONTEST
STORRS AGR. EXP. STATION----CONN. AGR. COLLEGE, STORRS, CONN.
NOVEMBER 1, 1916 - OCTOBER 30, 1917

VARIETY Barred Rock	RECORD 1ST YEAR	PEN NO.	1
OWNER Merritt M. Clark	SHOWROOM SCORE 87½	BAND NO.	9
OWNER'S ADDRESS Brookfield Center, Conn.		OWNER'S NO.	319

1916	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL		Weight of Eggs
																																Mo.	To Date	
NOV.		X		X		X			X			X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X		20	20	
DEC.	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	28	48	
JAN.	X	X	X	X	X	X	X	X	X		X		X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	27	75	
FEB.	X	X	X	X	X	X		X	X	X		X	X	X	X	X		X	X	X	X		X		X	X						21	96	
MAR.	X	X		X	X	X			X	X	X	X	X	X	X	X		X				X	X	X	X			X	X	X	X	22	118	
APR.	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		29	147	
MAY	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	28	175	
JUNE	X	X	X				B			0												X	X		X	X	X		X	X		10	185	
JULY	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			B				0				21	206	
AUG.								X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	22	228	
SEPT.	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X		27	255	
OCT.	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X			X	X			22	277	

DATE	WEIGHT	DATE	WEIGHT	
				AGGLUTINATION TEST, NEG. ✓ POS.
NOV. 1	6.3	JULY 1	6.8	REMARKS Best Plymouth Rock yet trap-nested at Storrs.
JAN. 1	6.0	SEPT. 1	6.9	
MAR. 1	7.0	OCT. 30	7.0	
MAY 1	6.5	AVE. WT.	6.6	

TABLE 5.

PRICES RECEIVED FOR EGGS—NOV. 1916 to NOV. 1917.

Nov. 1	61½¢	Mar. 7	38½¢	July 11	41½¢
" 8	65	" 14	32	" 18	42½
" 15	67½	" 21	34	" 25	44½
" 22	67½	" 28	37½	Aug. 1	47½
" 29	61	Apr. 4	37½	" 8	49½
Dec. 6	56½	" 11	35½	" 15	53
" 13	61	" 18	38½	" 22	55
" 20	64	" 25	36	" 29	53
" 27	64	May 2	36½	Sept. 5	52½
Jan. 3	55	" 9	36½	" 12	56
" 10	56½	" 16	38	" 19	57½
" 17	57½	" 23	39½	" 26	59
" 24	48	" 31	39½	Oct. 3	60
" 31	46½	June 6	38½	" 10	64
Feb. 7	50½	" 13	34	" 17	64
" 14	48½	" 20	39½	" 26	69
" 21	49½	" 27	40½	" 31	72½
" 28	39½	July 5	41½		

TABLE 6.

WEIGHT OF BIRDS

Breed	No. Birds	Nov. 1	Jan. 1	Mar. 1	May 1	July 1	Sept. 1	Oct. 31	Average
Plymouth Rocks	140	5.28	5.91	6.27	5.84	6.01	6.02	5.98	5.90
Wyandottes	180	4.78	5.02	5.31	5.01	5.18	5.26	5.32	5.12
R. I. Reds	210	5.18	5.61	5.98	5.61	5.78	5.71	5.73	5.65
White Leghorns	430	3.47	3.73	3.93	3.68	3.80	3.83	3.68	3.73

Barred Rock No. 9
Record 277 Eggs.

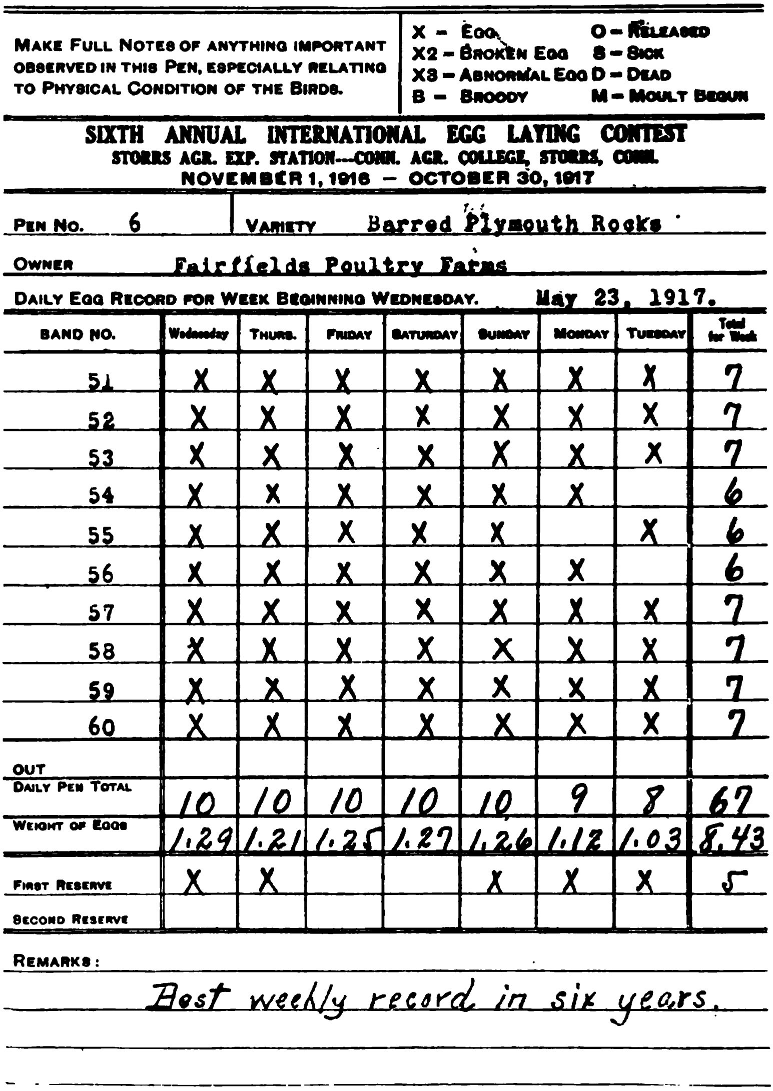
White Wyandottes No. 268
Record 263 Eggs.

TABLE 7.

MONTHLY EGG PRODUCTION

Average per pen for the breeds indicated.

Breed	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Year
Plymouth Rocks	39	69	98	117	179	189	184	183	163	145	150	94	1610
Wyandottes	54	89	100	130	190	184	168	175	152	146	151	114	1653
R. I. Reds	48	78	111	140	197	184	173	154	143	127	130	98	1583
White Leghorns	66	87	81	114	178	188	189	213	201	166	132	60	1675
Miscellaneous	53	73	86	122	182	158	149	159	128	130	127	94	1461
All Breeds	56	82	93	123	184	185	180	188	172	150	137	84	1634



MAKE FULL NOTES OF ANYTHING IMPORTANT OBSERVED IN THIS PEN, ESPECIALLY RELATING TO PHYSICAL CONDITION OF THE BIRDS.	X – EGG O – RELEASED X2 – BROKEN EGG S – SICK X3 – ABNORMAL EGG D – DEAD B – BROODY M – MOULT BEGUN

SIXTH ANNUAL INTERNATIONAL EGG LAYING CONTEST

STORRS AGR. EXP. STATION—CONN. AGR. COLLEGE, STORRS, CONN.

NOVEMBER 1, 1916 – OCTOBER 30, 1917

PEN NO. 6 VARIETY Barred Plymouth Rocks

OWNER Fairfields Poultry Farms

DAILY EGG RECORD FOR WEEK BEGINNING WEDNESDAY. May 23, 1917.

BAND NO.	Wednesday	THURS.	FRIDAY	SATURDAY	SUNDAY	MONDAY	TUESDAY	Total for Week
51	X	X	X	X	X	X	X	7
52	X	X	X	X	X	X	X	7
53	X	X	X	X	X	X	X	7
54	X	X	X	X	X	X		6
55	X	X	X	X	X		X	6
56	X	X	X	X	X	X		6
57	X	X	X	X	X	X	X	7
58	X	X	X	X	X	X	X	7
59	X	X	X	X	X	X	X	7
60	X	X	X	X	X	X	X	7
OUT								
DAILY PEN TOTAL	10	10	10	10	10	9	8	67
WEIGHT OF EGGS	1.29	1.21	1.25	1.27	1.26	1.12	1.03	8.43
FIRST RESERVE	X	X			X	X	X	5
SECOND RESERVE								

REMARKS:

Best weekly record in six years.

SIXTH ANNUAL INTERNATIONAL EGG LAYING CONTEST

STORRS AGR. EXP. STATION---CONN. AGR. COLLEGE, STORRS, CONN.
NOVEMBER 1, 1916 - OCTOBER 30, 1917

PEN NO. 79 VARIETY White Leghorns

OWNER W. E. Atkinson

FEED RECORD FOR THE MONTH OF August

Date	Mash	Grain	Grit	Charcoal	Oyster Shell				No. Hens
1	10.0	10.0							10
7	10.0	10.0							
10	5.0				1.0				
15		5.0			2.0				
18	10.0	10.0							
24	10.0	5.0			1.0				
Total	45.0	40.0	—	—	4.0				
Credit Back	3.1	2.0	—	—	—				
Consumed	41.9	38.0	—	—	4.0				

PEN NO. 80 VARIETY White Leghorns

OWNER Hilltop Poultry Yards

Date	Mash	Grain	Grit	Charcoal	Oyster Shell				No. Hens
1	10.0	10.0							10
7	10.0	10.0							
10	5.0				1.0				
15		5.0			2.0				
18	10.0	10.0							
24	10.0	5.0							
Total	45.0	40.0	—	—	3.0				
Credit Back	2.7	2.5	—	—	—				
Consumed	42.3	37.5	—	—	3.0				

Remarks

be economically impossible to give fowls the individual attention which is accorded them in the contest. There is also the factor of feed consumption which would doubtless be somewhat decreased under commercial conditions when the average annual production was lower than the figure attained by the contest birds. However, the authors are limited to reporting the facts as shown by the records and they desire to caution the reader against attempting to apply the results too strictly to commercial conditions.

COST OF FEED.

It is almost always true that dollars data are out of date by the time they are printed, if indeed they are not so before the time of going to press. With feed prices as they are at present and as they have been for many months it is difficult to realize that the prices herein reported could actually have been those under which feed for the sixth contest was bought. Of course, it must be remembered that the period under discussion began November 1, 1916. It should also be stated that practically all of the feed was purchased in car lots and usually somewhat in advance of immediate needs. The prices used in all the calculations were $3.00 per hundred for hard grain and $2.50 for mash, these figures representing the average cost of feed delivered at the plant. Grit and shell were figured at 75¢ per hundred and charcoal at $2.00. This made the cost of feed for the average bird $2.55 for the year; the extremes being $2.45 for the Leghorns and $2.75 for the Plymouth Rocks. In the previous contest the average cost of feed per bird was $1.88.

The cost of feed (except succulent food) for each dozen eggs produced was 17.5c for the Leghorns, 18.3c for the Wyandottes, 20.2c for the R. I. Reds and 20.5c for the Plymouth Rocks. The figures in each case are just about an even five cents per dozen higher than for the previous year.

Expressed in amounts of feed (mash and grain) it took, for each pound of eggs prodouced, 4.87, 4.64, 4.50 and 4.15 pounds, respectively, for the Rocks, Reds, Wyandottes and Leghorns. The average for all breeds was 4.44 pounds of feed for each pound of eggs or 6.71 pounds for each dozen.

TABLE 8.

COST OF FEED

Average per pen for the breeds indicated.

Breed	Mash Lbs.	Grain Lbs.	Grit Lbs.	Charcoal Lbs.	Oyster Shell Lbs.	Total Cost
Plymouth Rocks	527	465	6.3	3.3	29.1	$27.45
Wyandottes	461	447	6.6	3.3	29.7	25.25
R. I. Reds	513	451	6.8	3.2	29.8	26.70
White Leghorns	418	451	12.0	6.6	32.4	24.46
Miscellaneous	428	446	12.5	6.8	30.0	24.55
All Breeds	461	452	9.2	4.8	30.8	$25.49

TABLE 9.

RETURN ABOVE COST OF FEED

Average per pen for the breeds indicated.

Breed	Eggs	Weight of Eggs in Lbs.	Weight per Doz. in Ounces	Value of Eggs	Cost of Feed	Return Above Feed Cost
Plymouth Rocks	1610	203.67	24.3	$61.72	$27.45	$34.27
Wyandottes	1652	201.75	23.4	64.34	25.25	39.09
R. I. Reds	1588	207.92	25.2	61.09	26.70	34.39
White Leghorns	1675	209.37	24.0	63.85	24.46	39.39
Miscellaneous	1461	182.92	24.0	56.66	24.55	32.11
All Breeds	1634	205.82	24.2	$62.77	$25.49	$37.28

THE VALUE OF A HIGH EGG YIELD.

Of two hens laying unequal numbers of eggs, it is always possible that the one making the smaller record may have the more valuable product provided, of course, that she laid when prices were high. In general, however, the reverse condition is true and the number of eggs laid is a more or less direct indication of the returns to be realized. The three tables following are designed to make apparent the handicap under which a low producing hen is working when she tries to demonstrate her ability to return a profit to her owner.

During the first five contests held at Storrs there were 1387 White Leghorns that completed a year's record. There were ninety of these birds that laid from 61-100 eggs for the year; 316 that laid from 101-140; 529 that laid from 141-180; and 353 that fell in the group laying from 181-220. The average yearly production of these groups was 85, 123, 161 and 198, respectively. Their average monthly egg production is shown

TABLE 10.

Month	61-100 eggs for the year	101-140 eggs for the year	141-180 eggs for the year	181-220 eggs for the year
Nov.	2.1	2.6	4.8	7.3
Dec.	1.9	2.9	5.3	9.9
Jan.	1.7	2.3	5.0	9.0
Feb.	4.5	7.5	10.1	12.3
March	12.8	16.4	18.2	20.0
April	15.6	18.3	19.6	20.9
May	16.0	20.1	21.8	23.5
June	12.8	17.9	21.5	23.1
July	9.2	16.3	20.6	22.7
Aug.	5.6	13.4	19.0	21.5
Sept.	2.5	4.8	11.5	17.8
Oct.	.6	.9	3.4	8.9
Year	85.4	123.4	160.7	197.5

TABLE 11.

(Pounds of feed necessary to produce a dozen eggs.)

Month	61-100 egg group lbs.	101-140 egg group lbs.	141-180 egg group lbs.	181-220 egg group lbs.
Nov.	40.0	32.0	18.0	12.0
Dec.	44.0	29.0	16.0	8.5
Jan.	49.0	36.0	17.0	9.3
Feb.	19.0	11.0	8.3	6.6
Mar.	6.6	5.1	4.6	4.2
Apr.	5.4	4.6	4.3	4.0
May	5.2	4.2	3.8	3.6
June	6.6	4.7	3.9	3.6
July	9.1	5.2	4.1	3.7
Aug.	15.0	6.3	4.4	3.9
Sept.	34.0	18.0	7.3	4.7
Oct.	140.0	93.0	25.0	9.4
Year	11.8	8.2	6.3	5.1

in Table 10. Notice how few eggs were laid during the early and late months of the year by the birds in the low group. The production during these months increases rapidly as we pass from the low to the higher groups.

Using this table as a basis, and assuming that a Leghorn will consume an average of seven pounds of feed per month, the figures shown in Table 11 have been obtained. Actually, of course, the heavy laying hen will eat more than the non-layer and the table is, therefore, not absolutely correct. But for practical purposes it is close enough and no attempt has been made to correct the error. Table 11, then, shows the amount of feed (mash and grain) consumed each month, by the several groups, for each dozen eggs produced. In the low group, particularly, the increase in the amount of food necessary to result in a dozen eggs is very rapid from July to October. With feed at 3½¢ per pound the few eggs secured from the 85-egg hens in October will cost about $5.00 a dozen. This is a strong argument for culling out the slackers, the birds which will not continue to lay during the fall months. If these birds are culled out the last of July they will have paid for their feed and left a few cents to spare. If they are kept longer they entail a considerable loss. Obviously the logical procedure is to get these poor birds out of the way just as soon as they cease laying. The resultant effect on the ledger will be the same as if the average production of the flock had been increased. The labor and overhead charges will remain nearly constant, while the feed cost of egg production will be greatly reduced.

Table 12, in reality, is only another way of expressing the same idea. The first column indicates the number of eggs required per day from one hundred hens to pay for their feed when that feed is costing $3.50 a hundred, and when egg values are figured from the prices given in Table 4. It is assumed that one hundred Leghorns will consume 700 pounds of feed per

TABLE 12.

Month	Eggs per day to pay for feed for 100 hens	Eggs per day from 100 hens laying 61-100 eggs per year	Eggs per day from 100 hens laying 101-140 eggs per year	Eggs per day from 100 hens laying 141-180 eggs per year	Eggs per day from 100 hens laying 181-220 eggs per year
Nov.	15	7	9	16	24
Dec.	16	6	9	17	32
Jan.	19	6	7	16	29
Feb.	21	16	28	36	46
Mar.	26	41	53	59	65
Apr.	26	52	61	65	70
May	26	52	65	70	76
June	26	43	60	72	77
July	23	30	53	66	73
Oct.	15	2	3	11	20
Year	21	23	34	44	54

month. The other columns show the number of eggs per day which will be produced by one hundred hens of each group. For example, it takes fifteen eggs per day to pay for the feed of one hundred hens in November. A hundred hens of the type represented in the low group will average to produce only seven eggs per day during this month, or less than half enough to pay for their feed. Not until the end of April does the total number of eggs produced equal or exceed the number necessary to pay for the feed from November first on.

From such a table it is a comparatively easy matter to place any flock with reference to its income producing ability. If they averaged to lay 19 per cent in August they just nicely paid for their feed and the owner paid in addition for the privilege of taking care of them. If they laid 60 per cent during the same month they were bringing in an excellent return. A 200-egg flock would have been laying about 70 per cent and it is safe to say that the owner of any such flock need not be at all concerned about the high cost of feed.

Just a word of caution as to when to cull the poor birds may not be out of order. Our records seem to indicate that if they lay at all it will be during the spring months. If we cull them out at the end of the winter period for having laid no eggs up to that time they will go out of the flock leaving a big unpaid board bill. On the other hand, if we hold them all until the beginning of the summer period and cull them out as they cease laying they will have had an opportunity to pay for some of the feed they have eaten and when they are sent to the butcher there will not be so large an entry on the wrong side of the ledger.

TABLE 13.

MONTHLY EGG PRODUCTION BY PENS

Pen	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Year
1	22	45	133	170	224	230	229	186	183	209	198	162	1991
2	—	55	114	155	208	222	195	235	187	187	172	100	1830
3	59	49	41	99	148	162	157	175	158	131	174	71	1424
4	89	152	145	86	150	157	163	118	138	136	136	109	1579
5	19	82	123	104	189	152	129	123	124	95	105	55	1300
6	76	136	143	172	228	226	239	236	187	181	161	134	2119
7	—	63	112	140	154	180	183	180	139	152	161	102	1572
8	47	84	124	131	192	198	170	179	155	169	175	108	1732
9	27	44	79	129	192	197	201	171	159	174	169	139	1681
10	84	93	111	143	213	209	197	182	163	137	176	83	1791
11	—	—	9	37	155	167	162	197	186	111	62	14	1100
12	1	—	41	116	182	219	229	237	191	172	157	72	1617
13	94	139	135	90	130	165	160	174	167	94	144	81	1573
14	81	24	62	70	140	157	164	168	140	88	103	86	1283
15	55	148	140	154	192	163	117	125	123	133	145	125	1615
16	100	153	146	186	182	188	183	196	154	123	114	75	1800
17	29	69	66	135	200	193	186	172	169	173	125	115	1632
18	43	86	92	67	189	207	210	223	197	188	215	153	1820
19	86	70	89	151	202	195	199	179	160	151	148	92	1722
20	16	85	183	171	208	208	167	158	131	164	175	189	1855
21	82	126	103	160	196	160	152	152	167	161	166	87	1712
22	82	65	25	92	195	194	172	184	171	147	119	50	1496
23	78	78	97	114	190	183	172	166	148	125	128	88	1552

24	38	80	143	127	182	185	173	191	176	139	165	115	1714
25	63	66	77	159	151	156	123	155	117	153	174	115	1509
26	—	23	97	139	200	198	191	143	132	110	124	100	1457
27	20	105	159	148	205	152	161	183	134	147	170	158	1742
28	49	27	52	65	174	172	129	148	135	118	131	88	1288
29	44	75	140	145	211	201	168	176	155	167	171	176	1829
30	45	49	45	68	186	208	178	169	147	115	134	81	1425
31	92	157	92	115	216	185	189	233	174	163	175	145	1936
32	47	143	59	139	186	164	156	197	154	149	144	103	1641
33	18	16	107	138	170	199	200	172	193	170	152	143	1678
34	15	119	115	129	186	189	191	183	169	131	133	107	1667
35	65	84	85	121	221	161	175	130	107	116	64	60	1389
36	5	36	98	176	200	171	177	131	152	109	145	115	1515
37	40	155	177	130	185	198	193	192	155	148	136	71	1775
38	28	86	126	93	188	172	147	174	153	133	123	116	1539
39	47	93	153	157	185	180	152	169	181	175	170	108	1770
40	103	113	49	147	221	198	209	177	158	118	99	73	1665
41	21	82	109	153	206	208	165	150	130	139	152	129	1644
42	99	37	64	143	221	193	176	123	134	127	114	79	1510
43	69	110	178	161	212	193	185	165	146	134	174	106	1833
44	72	56	87	142	187	180	141	151	165	125	107	79	1492
45	15	99	167	170	218	173	201	170	143	149	162	123	1790
46	8	24	53	133	212	209	164	134	91	118	111	72	1329
47	64	107	158	169	227	222	227	194	163	156	166	142	1990
48	64	21	82	142	178	186	192	141	117	110	103	78	1414
49	21	61	75	106	142	143	116	81	92	42	49	9	937
50	105	117	172	171	195	179	173	133	148	109	171	139	1812
51	66	67	82	94	151	124	134	154	106	82	110	102	1272

TABLE 18. (continued)

Pen	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Year
52	30	35	67	155	213	178	130	155	159	138	137	85	1482
53	63	120	132	109	217	206	195	158	146	129	152	120	1747
54	113	90	126	149	211	201	165	159	123	123	152	133	1745
55	59	105	111	131	189	149	138	118	88	74	108	79	1349
56	85	134	79	94	209	206	222	229	227	192	149	63	1889
57	81	167	108	122	196	187	191	210	220	173	156	106	1917
58	3	71	107	124	191	192	193	234	198	168	148	84	1663
59	88	73	62	88	174	175	190	212	189	158	100	46	1555
60	103	157	156	141	195	208	203	222	204	179	133	66	1967
61	104	54	39	99	157	167	153	166	157	141	100	40	1377
62	71	63	89	112	182	188	186	232	220	177	122	33	1675
63	21	94	65	87	165	207	215	206	220	210	185	105	1780
64	47	38	14	106	181	196	187	229	204	166	147	81	1596
65	88	39	89	101	169	197	224	215	209	191	179	114	1815
66	39	58	92	109	183	209	223	233	237	219	191	109	1902
67	15	28	70	93	181	192	167	211	183	122	96	46	1404
68	22	22	104	97	120	151	160	176	166	154	182	123	1477
69	53	74	144	129	173	198	209	224	225	165	165	67	1826
70	55	78	84	123	169	188	197	229	209	160	185	80	1752
71	16	144	67	82	172	202	180	209	201	167	169	78	1687
72	64	127	52	94	191	210	178	196	197	144	92	22	1567
73	102	193	199	189	231	197	184	238	236	164	119	38	2090
74	81	114	63	124	198	186	168	216	202	140	137	98	1727
75	64	119	95	152	178	214	206	238	200	159	163	93	1881
76	20	29	35	108	159	178	190	196	184	146	106	22	1373

77	126	96	66	115	166	178	176	225	210	157	112	47	1674
78	128	135	132	148	170	159	181	215	200	185	165	103	1921
79	49	86	57	116	182	208	202	210	203	135	70	71	1589
80	163	147	126	183	172	199	217	224	198	183	135	58	1950
81	58	140	17	138	159	181	160	170	165	160	98	47	1488
82	149	144	95	90	180	188	184	225	223	219	133	66	1896
83	39	56	20	97	196	205	177	228	215	158	171	80	1642
84	16	19	12	101	141	155	162	187	178	138	77	4	1190
85	34	82	106	111	139	131	120	136	97	103	78	17	1154
86	104	101	104	102	173	192	174	215	174	152	86	22	1599
87	21	34	72	138	166	181	180	234	205	183	133	57	1604
88	80	95	82	113	196	211	213	237	219	193	148	58	1845
89	43	119	135	113	174	176	159	174	171	132	102	83	1581
90	106	76	61	74	179	191	193	205	195	178	121	49	1628
91	19	83	127	143	208	206	216	253	253	207	194	113	2022
92	85	148	130	128	195	176	218	245	238	202	103	27	1890
93	55	61	25	108	169	178	193	198	207	205	177	60	1636
94	29	15	68	151	180	212	217	207	221	186	146	41	1673
95	41	17	31	102	178	207	191	218	218	165	93	20	1481
96	49	57	59	110	167	177	193	201	178	125	74	5	1395
97	73	64	56	120	195	205	198	224	183	122	98	52	1590
98	167	90	67	89	181	138	171	211	186	172	143	61	1676
99	39	71	70	119	157	134	149	163	160	163	181	100	1456
100	—	25	37	90	172	146	145	198	139	160	119	64	1295
Total	5598	8231	9318	12319	18424	18548	17965	18749	17154	14995	13737	8408	163426

TABLE 14.

AMOUNT AND COST OF FEED CONSUMED

Pen	Mash lbs.	Grain lbs.	Grit lbs.	Charcoal lbs.	Oyster Shell lbs.	Cost
1	557	466	8	4.0	31	$28.29
2	504	482	5	3.5	29	27.38
3	579	476	7	2.5	31	29.09
4	565	469	8	3.8	28	28.57
5	467	454	6	2.5	29	25.59
6	526	469	8	3.5	31	27.57
7	443	476	6	2.5	27	25.66
8	494	462	7	2.5	31	26.56
9	542	471	6	5.8	30	28.04
10	562	461	6	3.5	30	28.23
11	542	474	4	3.8	26	28.10
12	553	446	4	2.5	27	27.49
13	497	451	8	2.8	29	26.30
14	551	447	5	2.5	28	27.48
15	415	452	8	2.8	29	24.29
16	457	481	6	2.5	29	26.17
17	480	439	4	2.5	32	25.48
18	457	452	5	1.5	28	25.27
19	440	457	7	4.5	32	25.10
20	388	445	7	3.8	31	23.40
21	466	458	4	2.8	29	25.71
22	471	429	8	4.2	30	25.01
23	408	442	6	4.2	28	23.80
24	501	437	7	2.5	29	25.96
25	458	441	6	2.8	28	24.99
26	448	435	6	2.5	30	24.57
27	542	449	11	3.5	33	27.40
28	480	443	6	3.5	26	25.58
29	479	458	6	4.8	33	26.13
30	468	432	6	3.5	26	24.95
31	456	449	10	3.5	33	25.26
32	477	441	6	3.5	29	25.47
33	581	454	5	2.5	28	28.43
34	562	442	6	3.8	32	27.69
35	450	437	7	3.5	28	24.69
36	476	459	6	3.5	28	25.99
37	602	456	9	3.8	29	29.11
38	510	448	7	4.8	29	26.53
39	519	473	9	3.8	33	27.54
40	543	447	7	2.5	30	27.32
41	551	470	6	2.5	31	28.21
42	426	449	9	4.2	31	24.51
43	530	453	9	2.8	33	27.22
44	517	415	6	3.5	31	25.74
45	573	469	7	2.5	32	28.73
46	467	448	5	2.5	30	25.43
47	554	469	7	2.5	32	28.28
48	525	448	6	2.5	28	26.84
49	437	424	4	2.5	27	23.90
50	544	450	9	2.5	30	27.44

Pen	Mash lbs.	Grain lbs.	Grit lbs.	Charcoal lbs.	Oyster Shell lbs.	Cost
51	410	442	5	2.8	26	$23.81
52	536	462	5	2.5	29	27.55
53	459	464	9	4.8	29	25.77
54	472	458	16	6.0	32	26.03
55	493	465	10	5.8	29	26.69
56	483	459	13	5.5	35	26.30
57	412	453	12	5.8	28	24.29
58	386	465	10	5.8	33	24.07
59	449	447	14	6.2	35	25.10
60	461	461	12	5.8	33	25.82
61	332	445	12	6.0	29	22.07
62	412	460	10	5.8	32	24.53
63	388	453	13	6.2	33	23.78
64	368	453	11	6.0	32	23.22
65	449	458	16	8.5	34	25.52
66	376	446	12	7.2	33	23.25
67	299	450	9	5.8	31	21.38
68	526	455	12	8.0	36	27.33
69	465	458	13	8.0	36	25.92
70	404	409	12	8.8	31	22.85
71	445	442	10	6.0	34	24.83
72	349	444	12	7.0	33	22.51
73	475	444	15	7.2	33	25.68
74	415	440	10	6.8	29	24.02
75	448	453	12	7.0	31	25.24
76	317	445	9	7.2	31	21.73
77	458	453	15	8.5	32	25.56
78	458	471	16	8.0	34	26.14
79	434	448	12	7.5	34	24.79
80	426	463	13	5.8	35	25.01
81	443	455	14	6.0	31	25.15
82	492	465	14	6.2	33	26.72
83	413	452	9	6.0	34	24.34
84	394	439	10	6.0	31	23.45
85	354	448	10	5.8	28	22.73
86	456	463	16	7.2	35	25.80
87	358	440	12	5.8	31	22.59
88	424	438	11	7.0	31	24.19
89	362	453	13	4.8	30	23.04
90	418	456	9	4.8	33	24.54
91	495	458	13	5.8	33	26.59
92	510	452	17	6.8	36	26.87
93	454	444	13	6.0	32	25.10
94	364	464	10	7.0	31	23.47
95	370	441	10	8.2	32	22.95
96	364	464	9	5.8	31	23.44
97	437	452	11	6.2	32	24.94
98	433	451	12	7.0	30	24.79
99	337	431	12	7.0	30	21.81
100	410	431	12	8.5	29	23.67
Totals	46133	45217	918	481.0	3079	$2549.45

TABLE 15.

SUMMARY OF DATA ON EACH PEN

Pen	Eggs	Weight of Eggs in pounds	Weight per dozen in ounces	Value of Eggs	Cost of Feed	Return Above Feed Cost
1	1991	252.88	24.4	$76.80	$28.29	$48.51
2	1830	202.75	21.3	69.02	27.38	41.64
3	1424	185.35	25.0	54.71	29.09	25.62
4	1579	189.63	23.1	63.79	28.57	35.22
5	1300	155.19	22.9	49.65	25.59	24.06
6	2119	270.66	24.5	82.45	27.57	54.88
7	1572	195.67	24.0	60.21	25.66	34.55
8	1732	212.39	23.5	67.38	26.56	40.82
9	1681	205.94	23.5	64.71	28.04	36.67
10	1791	231.87	24.9	69.27	28.23	41.04
11	1100	148.46	25.9	38.21	28.10	10.11
12	1617	221.41	26.3	59.02	27.49	31.53
13	1573	200.53	24.5	62.47	26.30	36.17
14	1233	178.57	27.8	46.36	27.48	18.88
15	1615	190.68	22.7	64.86	24.29	40.57
16	1800	217.32	23.2	70.57	26.17	44.40
17	1632	209.69	24.7	62.39	25.48	36.91
18	1820	212.98	22.5	71.29	25.27	46.02
19	1722	213.70	23.8	66.42	25.10	41.32
20	1855	219.47	22.7	73.38	23.40	49.98
21	1712	197.82	22.2	67.68	25.71	41.97
22	1496	186.87	24.0	56.45	25.01	31.44
23	1552	184.55	22.8	59.90	23.80	36.10
24	1714	226.76	25.4	66.51	25.96	40.55
25	1509	186.08	23.7	59.86	24.99	34.87
26	1457	174.48	23.0	54.48	24.57	29.91
27	1742	211.60	23.8	68.90	27.40	41.50
28	1288	173.05	25.8	49.15	25.58	23.57
29	1829	218.93	23.0	72.00	26.12	45.88
30	1425	180.94	24.4	53.63	24.95	28.68
31	1986	234.51	23.3	76.64	25.26	51.38
32	1641	192.43	22.5	64.16	25.47	38.69
33	1678	219.49	25.1	64.20	28.43	35.77
34	1667	230.08	26.5	64.18	27.69	36.49
35	1389	182.78	25.3	52.84	24.69	28.15
36	1515	199.01	25.2	57.72	25.99	31.73
37	1775	237.51	25.7	68.93	29.11	39.82
38	1539	211.66	26.4	59.66	26.53	33.13
39	1770	231.60	25.1	69.42	27.54	41.88
40	1665	215.44	24.8	63.77	27.32	36.45
41	1644	222.76	26.0	63.68	28.21	35.47
42	1510	181.85	23.1	57.81	24.51	33.30
43	1833	227.79	23.9	71.98	27.22	44.76
44	1492	202.59	26.1	57.28	25.74	31.54
45	1790	238.98	25.6	69.53	28.73	40.80
46	1329	173.53	25.1	49.10	25.48	23.67
47	1990	256.39	24.7	77.52	28.28	49.24
48	1414	179.30	24.3	53.47	26.84	26.63
49	937	127.75	26.2	34.63	23.90	10.73
50	1812	248.59	26.3	72.70	27.44	45.26

Pen	Eggs	Weight of Eggs in pounds	Weight per dozen in ounces	Value of Eggs	Cost of Feed	Return Above Feed Cost
51	1272	156.85	23.7	$49.92	$23.81	$26.11
52	1482	206.97	26.8	56.20	27.55	28.65
53	1747	215.21	23.7	68.30	25.77	42.53
54	1745	220.36	24.2	69.14	26.03	43.11
55	1349	172.76	24.6	52.83	26.69	26.14
56	1889	251.30	25.5	72.43	26.30	46.13
57	1917	230.92	23.1	75.33	24.29	51.04
58	1663	204.10	23.6	61.75	24.07	37.68
59	1555	207.08	25.6	58.87	25.10	33.77
60	1967	221.20	21.6	76.64	25.82	50.82
61	1377	166.82	23.3	52.60	22.07	30.53
62	1675	212.13	24.3	62.96	24.53	38.43
63	1780	219.26	23.7	68.28	23.78	44.50
64	1596	199.25	24.0	59.78	23.22	36.56
65	1815	233.85	24.7	70.05	25.52	44.53
66	1902	227.81	23.0	72.66	23.25	49.41
67	1404	179.83	24.6	51.23	21.38	29.85
68	1477	177.32	23.1	57.45	27.33	30.12
69	1826	227.01	23.9	69.64	25.92	43.72
70	1752	219.90	24.1	67.17	22.85	44.32
71	1687	217.62	24.8	64.78	24.83	39.95
72	1567	200.58	24.6	58.86	22.51	36.35
73	2090	252.93	23.2	81.18	25.68	55.50
74	1727	214.05	23.8	66.83	24.02	42.81
75	1881	244.12	24.9	72.50	25.24	47.26
76	1373	170.25	23.8	49.97	21.73	28.24
77	1674	207.75	23.8	64.45	25.56	38.89
78	1921	237.16	23.7	76.51	26.14	50.37
79	1589	205.20	24.8	59.37	24.79	34.58
80	1950	244.59	24.1	76.57	25.01	51.56
81	1488	198.05	25.6	57.04	25.15	31.89
82	1896	249.32	25.2	74.60	26.72	47.88
83	1642	220.27	25.8	61.70	24.34	37.36
84	1190	148.31	23.9	42.58	23.45	19.13
85	1154	144.83	24.1	43.95	22.73	21.22
86	1599	207.32	24.9	60.87	25.80	35.07
87	1604	195.05	23.3	59.77	22.59	37.18
88	1845	226.86	23.6	70.22	24.19	46.03
89	1581	192.46	23.4	61.22	23.04	38.18
90	1628	205.27	24.2	62.15	24.54	37.61
91	2022	239.73	22.8	77.24	26.59	50.65
92	1890	226.06	23.0	72.24	26.87	45.37
93	1636	215.35	25.3	62.25	25.10	37.15
94	1673	191.90	22.0	61.69	23.47	38.22
95	1481	184.55	23.9	53.56	22.95	30.61
96	1395	182.68	25.1	50.99	23.44	27.55
97	1590	205.01	25.8	59.27	24.94	34.33
98	1676	196.45	22.5	66.02	24.79	41.23
99	1456	179.19	23.6	56.66	21.81	34.85
100	1295	159.37	23.6	48.03	23.67	24.36

TABLE 15.

SUMMARY OF DATA ON EACH PEN

Pen	Eggs	Weight of Eggs in pounds	Weight per dozen in ounces	Value of Eggs	Cost of Feed	Return Above Feed Cost
1	1991	252.88	24.4	$76.80	$28.29	$48.51
2	1830	202.75	21.3	69.02	27.38	41.64
3	1424	185.35	25.0	54.71	29.09	25.62
4	1579	189.63	23.1	63.79	28.57	35.22
5	1300	155.19	22.9	49.65	25.59	24.06
6	2119	270.66	24.5	82.45	27.57	54.88
7	1572	195.67	24.0	60.21	25.66	34.55
8	1732	212.39	23.5	67.38	26.56	40.82
9	1681	205.94	23.5	64.71	28.04	36.67
10	1791	231.87	24.9	69.27	28.23	41.04
11	1100	148.46	25.9	38.21	28.10	10.11
12	1617	221.41	26.3	59.02	27.49	31.53
13	1573	200.53	24.5	62.47	26.30	36.17
14	1233	178.57	27.8	46.36	27.48	18.88
15	1615	190.68	22.7	64.86	24.29	40.57
16	1800	217.32	23.2	70.57	26.17	44.40
17	1632	209.69	24.7	62.39	25.48	36.91
18	1820	212.98	22.5	71.29	25.27	46.02
19	1722	213.70	23.8	66.42	25.10	41.32
20	1855	219.47	22.7	73.38	23.40	49.98
21	1712	197.82	22.2	67.68	25.71	41.97
22	1496	186.87	24.0	56.45	25.01	31.44
23	1552	184.55	22.8	59.90	23.80	36.10
24	1714	226.76	25.4	66.51	25.96	40.55
25	1509	186.08	23.7	59.86	24.99	34.87
26	1457	174.48	23.0	54.48	24.57	29.91
27	1742	211.60	23.3	68.90	27.40	41.50
28	1288	173.05	25.8	49.15	25.58	23.57
29	1829	218.93	23.0	72.00	26.12	45.88
30	1425	180.94	24.4	53.63	24.95	28.68
31	1986	234.51	23.3	76.64	25.26	51.38
32	1641	192.43	22.5	64.16	25.47	38.69
33	1678	219.49	25.1	64.20	28.43	35.77
34	1667	230.08	26.5	64.18	27.69	36.49
35	1389	182.78	25.3	52.84	24.69	28.15
36	1515	199.01	25.2	57.72	25.99	31.73
37	1775	237.51	25.7	68.93	29.11	39.82
38	1539	211.66	26.4	59.66	26.53	33.13
39	1770	231.60	25.1	69.42	27.54	41.88
40	1665	215.44	24.8	63.77	27.32	36.45
41	1644	222.76	26.0	63.68	28.21	35.47
42	1510	181.85	23.1	57.81	24.51	33.30
43	1833	227.79	23.9	71.98	27.22	44.76
44	1492	202.59	26.1	57.28	25.74	31.54
45	1790	238.98	25.6	69.53	28.73	40.80
46	1329	173.53	25.1	49.10	25.43	23.67
47	1990	256.39	24.7	77.52	28.28	49.24
48	1414	179.30	24.3	53.47	26.84	26.63
49	937	127.75	26.2	34.63	23.90	10.73
50	1812	248.59	26.3	72.70	27.44	45.26

Pen	Eggs	Weight of Eggs in pounds	Weight per dozen in ounces	Value of Eggs	Cost of Feed	Return Above Feed Cost
51	1272	156.85	23.7	$49.92	$23.81	$26.11
52	1482	206.97	26.8	56.20	27.55	28.65
53	1747	215.21	23.7	68.30	25.77	42.53
54	1745	220.36	24.2	69.14	26.03	43.11
55	1349	172.76	24.6	52.83	26.69	26.14
56	1889	251.30	25.5	72.43	26.30	46.13
57	1917	230.92	23.1	75.33	24.29	51.04
58	1663	204.10	23.6	61.75	24.07	37.68
59	1555	207.08	25.6	58.87	25.10	33.77
60	1967	221.20	21.6	76.64	25.82	50.82
61	1377	166.82	23.3	52.60	22.07	30.53
62	1675	212.13	24.3	62.96	24.53	38.43
63	1780	219.26	23.7	68.28	23.78	44.50
64	1596	199.25	24.0	59.78	23.22	36.56
65	1815	233.85	24.7	70.05	25.52	44.53
66	1902	227.81	23.0	72.66	23.25	49.41
67	1404	179.83	24.6	51.23	21.38	29.85
68	1477	177.32	23.1	57.45	27.33	30.12
69	1826	227.01	23.9	69.64	25.92	43.72
70	1752	219.90	24.1	67.17	22.85	44.32
71	1687	217.62	24.8	64.78	24.83	39.95
72	1567	200.58	24.6	58.86	22.51	36.35
73	2090	252.93	23.2	81.18	25.68	55.50
74	1727	214.05	23.8	66.83	24.02	42.81
75	1881	244.12	24.9	72.50	25.24	47.26
76	1373	170.25	23.8	49.97	21.73	28.24
77	1674	207.75	23.8	64.45	25.56	38.89
78	1921	237.16	23.7	76.51	26.14	50.37
79	1589	205.20	24.8	59.37	24.79	34.58
80	1950	244.59	24.1	76.57	25.01	51.56
81	1488	198.05	25.6	57.04	25.15	31.89
82	1896	249.32	25.2	74.60	26.72	47.88
83	1642	220.27	25.8	61.70	24.34	37.36
84	1190	148.31	23.9	42.58	23.45	19.13
85	1154	144.83	24.1	43.95	22.73	21.22
86	1599	207.32	24.9	60.87	25.80	35.07
87	1604	195.05	23.3	59.77	22.59	37.18
88	1845	226.86	23.6	70.22	24.19	46.03
89	1581	192.46	23.4	61.22	23.04	38.18
90	1628	205.27	24.2	62.15	24.54	37.61
91	2022	239.73	22.8	77.24	26.59	50.65
92	1890	226.06	23.0	72.24	26.87	45.37
93	1636	215.35	25.3	62.25	25.10	37.15
94	1673	191.90	22.0	61.69	23.47	38.22
95	1481	184.55	23.9	53.56	22.95	30.61
96	1395	182.68	25.1	50.99	23.44	27.55
97	1590	205.01	25.8	59.27	24.94	34.33
98	1676	196.45	22.5	66.02	24.79	41.23
99	1456	179.19	23.6	56.66	21.81	34.85
100	1295	159.37	23.6	48.03	23.67	24.36

LIST OF ENTRIES.

BARRED ROCKS.

Pen.	Owner and Address.
1	Merrit M. Clark, Brookfield Center, Conn.
2	Michigan Agricultural College, East Lansing, Mich.
3	A. B. Hall, Wallingford, Conn.
4	Jules F. Francais, W. Hampton Beach, L. I.
5	Hampton Institute, Hampton, Va.
6	Applecock Farm, Fitzwilliam, N. H.
7	Norfolk Specialty Farms, St. Williams, Ontario.
8	Rodman Schaff, Fitzwilliam, N. H.
9	Rock Rose Farm, Katonah, N. Y.

WHITE ROCKS.

Pen.	Owner and Address.
10	Holliston Hill P. Farm, Holliston, Mass.
11	Benjamin F. Low, Derry, N. H.
12	Albert T. Lenzen, North Attleboro, Mass.

BUFF ROCKS.

Pen.	Owner and Address.
13	Koshaw Farms, Granby, Conn.
14	A. A. Hall, Danbury, Conn.

WHITE WYANDOTTES

Pen.	Owner and Address.
15	A. L. Mulloy, Waterbury, Conn.
16	Merrythought Farm, Columbia, Conn.
17	A. L. Vreeland, Nutley, N. J.
18	Grant Buler & Son, Trooper, Pa.
19	Joseph Moreau, Wallum Lake, R. I.
20	Obed G. Knight, Bridgeton, R. I.
21	Brayman Farm, Westville, N. H.
22	Beulah Farm, Stony Creek, Ontario.
23	Vine Hill Farm, Ipswich, Mass.
24	Mrs. R. W. Stevens, Stillwater, N. Y.
25	Everett E. Wheeler, Quincy, Mass.
26	J. E. Watson, Marbledale, Conn.
27	Tom Barron, Catforth, nr. Preston, England.
28	Harry Kendall, Sterlington, N. Y.
29	Jay H. Ernisse, Klem Road, Webster, N. Y.
30	Nybrook Farm, Valley Stream, L. I.

BUFF WYANDOTTES.

Pen.	Owner and Address.
31	H. P. Cloyes & H. R. Sullivan, Hartford, Conn.
32	Dr. N. W. Sanborn, Holden, Mass.

RHODE ISLAND REDS.

Pen.	Owner and Address.
33	Frank E. Turner, Attleboro, Mass.
34	Frank E. Turner, Attleboro, Mass.
35	Colonial Farm, Temple, N. H.
36	A. B. Brundage, Danbury, Conn.
37	Flintstone Farm, Dalton, Mass.
38	Homer P. Deming, Winsted, Conn.
39	Charles O. Polhemus, Newburgh, N. Y.
40	Pequot Poultry Farm, Southport, Conn.
41	Springdale Poultry Farm, Durham, Conn.
42	Laurel Hill Farm, Bridgeton, R. I.
43	Pequot Poultry Farm, Southport, Conn.
44	Harry B. Cook, Orange, Conn.
45	A. W. Rumery, Danville, N. H.
46	F. M. Peasley, Cheshire, Conn.
47	Allan's Hardtobeat Reds, Newport, R. I.
48	Glenview Poultry Farm, Rockville, Conn.
49	Fatherland Farm, Byfield, Mass.
50	Jacob E. Jansen, North Haven, Conn.
51	Royal Farms, Amston, Conn.
52	Conyers Farm, Greenwich, Conn.
53	Pinecrest Orchards, Groton, Mass.

WHITE ORPINGTONS.

Pen.	Owner and Address.
54	Obed G. Knight, Bridgeton, R. I.
55	Harry Paxton, Gloversville, N. Y.

WHITE LEGHORNS.

Pen.	Owner and Address.
56	A. B. Hall, Wallingford, Conn.
57	Braeside Poultry Farm, Stroudsburg, Pa.
58	Jay H. Ernisse, Klem Road, Webster, N. Y.
59	Broad Brook Farm, Bedford Hills, N. Y.
60	J. O. LeFevre, New Paltz, N. Y.
61	Rollwood Poultry Farm, Guilford, Conn.
62	Wm. L. Gilbert Home, Winsted, Conn.
63	Francis F. Lincoln, Mt. Carmel, Conn.
64	P. G. Platt, Wallingford, Pa.
65	Koshaw Farms, Granby, Conn.
66	F. M. Peasley, Cheshire, Conn.
67	Chas. Heigl, Rocky River, Ohio.
68	Tom Barron, Catforth, nr. Preston, England.
69	Will Barron, Bartle, nr. Preston, England.
70	J. Collinson, Barnacre, Garstang, England.
71	Abel Latham, Brierfield, Lancashire, England.
72	Bushkill Poultry Farm, Bushkill, Pa.
73	A. P. Robinson, Calverton, N. Y.
74	Eglantine Farm, Greensboro, Md.
75	Frank R. Hancock, Jacksonville, Vt.
76	Margareta P. Farm, Rocky River, Ohio.
77	Merrythought Farm, Columbia, Conn.
78	E. A. Ballard, Chestnut Hill, Pa.
79	W. E. Atkinson, Wallingford, Conn.
80	Hilltop Poultry Yards, Suffield, Conn.
81	N. W. Hendryx, New Haven, Conn.
82	Clifford I. Stoddard, Woodbridge, Conn.
83	George Phillips, Seymour, Conn.
84	Hampton Institute, Hampton, Va.
85	Toth Bros., Wallingford, Conn.
86	W. E. Robinson, Springfield, Ill.
87	Oak Hill Estate, Uniontown, Pa.
88	Geo. A. Stannard, Ottawa, Kans.
89	Jas. F. Harrington, Hammonton, N. J.
90	H. W. Collingwood, Woodcliffe Lake, N. J.
91	Windsweep Farm, Redding Ridge, Conn.
92	Windsweep Farm, Redding Ridge, Conn.
93	W. J. Cocking, Vineland, N. J.
94	M. J. Quackenbush, Nutley, N. J.
95	Dr. E. P. Holmes, Convene, Me.
96	Hillview Farm, Lincoln, Mo.
97	Conyers Farm, Greenwich, Conn.
98	Frances H. Mersereau, West Willington, Conn.

SILVER CAMPINES.

Pen.	Owner and Address.
99	Eugene Van Why, Winsted, Conn.
100	Uncowa Campine Yards, Southport, Conn.

PART II.

REPORT OF THE SEVENTH COMPETITION AND SOME FIVE YEAR AVERAGES.

When one considers five years' contest records as a whole, there appears to be nearly an even chance for any breed to win. The 1913-14 contest was won by a pen of White Leghorns that belonged to Francis F. Lincoln, Mt. Carmel, Conn. Their record for the year was 2088 eggs. The next, or fourth contest was won by a pen of White Wyandottes entered by Tom Barron, Catforth, England. These ten hens laid 2072 eggs. In 1915-16 Obed G. Knight of Bridgeton, R. I., furnished a pen of Wyandottes that were winners with a fine score of 2265 eggs. In the sixth contest, reported in the first part of this bulletin, a pen of Barred Rocks owned by Fairfield Poultry Farms, Short Falls, N. H., outlaid all their competitors, finishing the year with 2119 eggs. In the seventh competition, which closed October 30th, 1918, a pen of Oregons won first place with a total of 2352 eggs. Moreover, the Oregons established a new high record for a pen of ten birds in any American contest.

If one considers individual records, the best bird in the 1913-14 competition was a White Wyandotte that belonged to Merrythought Farm, Columbia, Conn. This hen laid 265 eggs during the year. In 1914-15 a Rhode Island Red owned by Hillview Poultry Farm, St. Albans, Vt., made the best individual record with a yield of 257 eggs. In 1915-16 individual honors went to a White Leghorn owned by A. P. Robinson of Calverton, N. Y., with the excellent record of 286 eggs. In the sixth competition a Barred Plymouth Rock pullet entered by Merrit M. Clark of Brookfield Center, Conn., won first place among individuals with a yield of 277 eggs. In the contest now being reported a White Wyandotte entered by Obed G.

Knight of Bridgeton, R. I., made the very exceptional record of 308 eggs. During the past seven years approximately 20,000 hens have been trap-nested in more than a score of egg laying contests in this country and Canada, but only three individuals have reached the 300 egg mark, namely: a White Plymouth Rock in the New Jersey contest at Vineland, a White Leghorn in the Delaware contest at Newark, and the Wyandotte mentioned above.

When laying contests were started several years ago some persons expected to see the question of "Which is the best breed?" settled beyond dispute within a comparatively short time. In the opinion of the authors the competitions have done just the opposite, they have shown conclusively that there is no one best breed, there are good points about each breed as well as some that are less desirable. Contest records have helped to point out the existing differences between breeds and in this respect may be helpful to the individual in making a choice. In addition to the fact that both individual and pen winnings have been well distributed among the competing breeds and varieties, a feature which stands out clearly is the variation between breeds with respect to seasonal distribution of egg production. There is a marked tendency, for instance, for Wyandottes to outlay all their competitors during September and October at the end of their pullet year. Similarly Leghorns enjoy a distinct advantage in July. Table 16 gives the average monthly egg production per pen of ten birds for each of the four principal breeds during each month of the contest year. The results there shown were derived from the combined data of the third, fourth, fifth, sixth, and seventh contests. As the idea to be brought out by this table is the effect of season on distribution of egg production, the records of each year have been given equal weight without regard to the actual number of birds involved in any case. The same information is shown graphically by the diagram on another page. By following down the first column in Table 16 one can see at a glace which breed ranked first in the matter of egg production in any month.

TABLE 16.

Monthly Egg Production by Pens of each of the Four Principal Breeds. Figures are from combined data of the 3rd, 4th, 5th, 6th and 7th contests, Involving a total of 4810 pullets.

MONTH	FIRST	SECOND	THIRD	FOURTH
November	White Leghorns 61	Wyandottes 49	R. I. Reds 34	Plymouth Rocks 32
December	Wyandottes 92	R. I. Reds 73	White Leghorns 68	Plymouth Rocks 66
January	Wyandottes 110	R. I. Reds 97	Plymouth Rocks 80	White Leghorns 65
February	R. I. Reds 128	Wyandottes 125	Plymouth Rocks 112	White Leghorns 102
March	Plymouth Rocks 184	R. I. Reds 184	Wyandottes 177	White Leghorns 176
April	White Leghorns 191	Plymouth Rocks 186	R. I. Reds 180	Wyandottes 179
May	White Leghorns 212	Plymouth Rocks 186	Wyandottes 182	R. I. Reds 176
June	White Leghorns 203	Plymouth Rocks 172	Wyandottes 167	R. I. Reds 157
July	White Leghorns 195	Plymouth Rocks 155	Wyandottes 150	R. I. Reds 144
August	White Leghorns 173	Wyandottes 154	Plymouth Rocks 150	R. I. Reds 135
September	Wyandottes 142	Plymouth Rocks 130	R. I. Reds 123	White Leghorns 122
October	Wyandottes 105	R. I. Reds 84	Plymouth Rocks 82	White Leghorns 53
Year	Wyandottes 1631	White Leghorns 1619	Plymouth Rocks 1534	R. I. Reds 1514

MORTALITY.

The mortality for the 1000 birds entered in the seventh competition amounted to a total of 150 individuals. This is considerably greater than the total number of deaths occurring in any previous year. The cause for such an increase may be explained on three grounds. In the first place the winter of 1917-18 was the most severe which has been experienced since the competitions at Storrs were started. The severity of weather conditions is shown by the fact that on two occasions the temperature dropped to a lower point than it had reached in the previous twenty-eight years, which covers the history of the weather station established at Storrs. As a matter of fact, records from the government station at Amherst, Mass., show that the winter in question was the severest in more than 100 years. The second factor making for a higher mortality was the lower quality of feeds which had to be used. Obviously when a poor quality of wheat, kiln dried corn, and oats containing a fairly large per cent of hull make up the chief part of the grain ration, it is evident that birds must consume a larger quantity of feed by weight in order to secure the same amount of total nutriment that they would obtain from a smaller amount of good quality feed. The feed records indicate that this is exactly what occurred, for the total consumption of mash and grain was greater for all breeds than it had been in any previous year. The authors feel certain that this fact subjected the birds to a greater physical strain and thus helped to swell mortality figures. A third factor involved in this connection may be best explained by saying that the management spent less time fussing with sick birds. In other words, more birds were killed than in previous years. When a bird did not respond to treatment within a reasonable time she was killed; that is to say, it was considered better to have a few more dead birds than to have some alive which were entirely useless.

Table 17 shows the distribution of mortality figures by months and causes of death. As in previous competitions liver trouble, worms, and disorders of the egg producing organs together with colds, canker, and internal hemorrhage have been responsible for the majority of deaths. There were seven cases

TABLE 17.

MORTALITY 1917-18.

Number and Causes of Deaths Each Month.

Month	Accidental	Colds and Canker	Going Light	Internal Hemorrhage	Liver and Spleen	Worms	Prolapsus of the Oviduct	Yolk in Body Cavity	Intestinal Disorders	Paralysis	Tumors	Doubtful	Miscellaneous	Total
November	1				1	1	1	1					2	7
December					1		1			1				3
January	1					2			1	1	1	1		7
February	3	1		3	1			1	1	1		1		12
March	1	1		4	1		1	1	2		1		1	13
April		5			4	7							3	19
May		4	3	3	5	1	1	1					2	20
June	1	6	1	2			1	1		1	1		1	15
July	1	1	2	1	4	1		2		1	1		1	15
August	1	1	1	2	2	1	1	3					1	13
September	3		4	4	2	2	2			1				18
October			2	1		1				1			3	8
Year	12	19	13	20	21	16	8	10	4	7	4	2	14	150

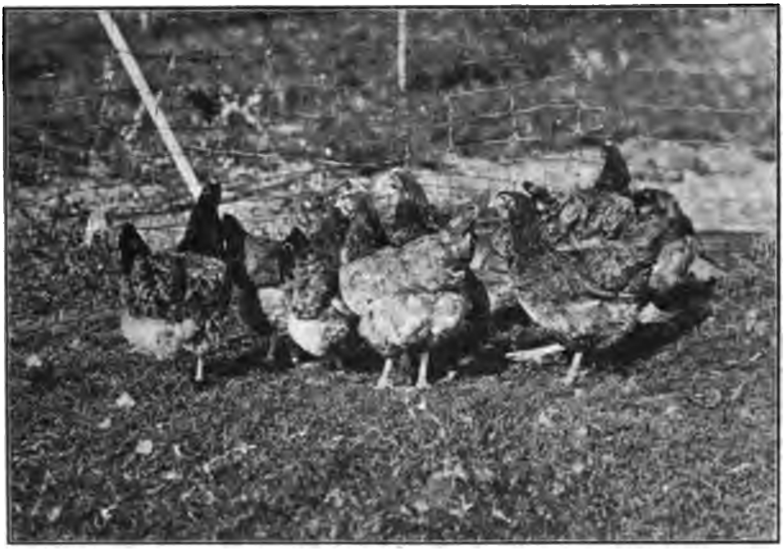
of paralysis, thirteen of "going light," and twelve accidental deaths. Considering the monthly distribution of mortality, there would seem to be some basis for a theory that mortality and egg production tend to go together. Beginning with seven deaths in November, mortality figures rise to a maximum of twenty in May, then gradually fall off to eight in the month of October.

During the past year a hospital house has been built at one corner of the contest plant. This is a building 12x12 ft., built over a concrete floor and foundation, with internal arrangements consisting chiefly of coops for individual birds while undergoing treatment. Thus, any bird coming to the contest is assured of a private room and individual care and attention during such time as she may be indisposed.

Hospital House

EXHIBITION QUALITY.

In considering the birds entered in the seventh competition from the point of view of show room quality, the management decided to dispense with the score card system employed in the previous three years. Accordingly all birds were judged on a comparison basis. This method simplified the judging process considerably and saved a great amount of clerical work, while at the same time each pen could be placed in exactly its proper relationship to all other pens of the same variety. Inasmuch as there has been considerable agitation on the question of whether or not show qualities and egg laying ability can be combined in the same individual, it is interesting to see what the contest records have to show on this problem. The average production per pen of ten birds in the seventh competition was 1690, 1394, 1683, 1530, 1480, and 1628 eggs respectively for Barred Rocks, White Rocks, White Wyandottes, Buff Wyandottes, Rhode Island Reds, and White Leghorns. The corresponding figures for those pens comprising the best 25 per cent of each variety when considered from a show room standpoint were 1739, 1346, 1834, 1582, 1390, and 1672



R. I. Reds, Record 1962 Eggs.

respectively. In the case of White Plymouth Rocks the number of pens was only four, and consequently the figures are less suggestive than in the case of White Leghorns, where forty-three pens were entered. Taken as a whole, however, this material certainly constitutes an argument for the contention that show room and utility qualities can be combined in the same strain of birds. Following is a table showing by numbers the pens which won the first ten places in each of six varieties.

Variety	1	2	3	4	5	6	7	8	9	10
Barred Rocks	11	9	6	13	2	3	4	5	8	10
White Rocks	17	15	16	14	—	—	—	—	—	—
White Wyandottes	24	21	22	26	20	19	23	25	28	27
Buff Wyandottes	29	30	34	32	33	31	—	—	—	—
R. I. Reds	38	46	40	51	41	37	39	42	50	47
White Leghorns	63	86	92	74	70	60	82	59	76	73

MARKETING THE PRODUCT.

As in previous competitions, practically the entire output of the contest has been sold either to the college dining hall or to a butter and egg store in New Haven. The prices have been the average New York quotation on State, Pennsylvania, and nearby western, hennery whites, fine to fancy, as such quotations appear in the Producers' Price-Current on Wednesday of each week. The following table shows the prices by weeks which were received for eggs thruout the year. During the 1915-16 competition the highest price received in any one week was 61½ cents per dozen. For more than half the time during the competition now being reported, or in other words for twenty-seven weeks, the wholesale price received was higher than this top figure two years ago. Taking any single week thruout the year the price received for eggs was higher than in any previous competition. As a matter of fact, in most weeks it was higher than any corresponding figure previously known in the history of the New York market.

PRICES RECEIVED FOR EGGS NOV. 1917—NOV. 1918.

Nov. 7	.76	Feb. 6	.64	May 8	.41½	Aug. 7	.58
" 14	.77½	" 13	.57	" 15	.41	" 14	.61½
" 21	.75	" 20	.65	" 22	.39	" 21	.67
" 28	.74	" 27	.52½	" 29	.41½	" 28	.66½
Dec. 5	.68½	Mar. 6	.47½	June 5	.43	Sept. 4	.64
" 12	.68	" 13	.46½	" 12	.45	" 11	.66
" 19	.71	" 20	.46½	" 19	.49	" 18	.66
" 26	.71	" 27	.45½	" 26	.51	" 25	.66½
Jan. 2	.74	April 3	.40	July 3	.53	Oct. 2	.70½
" 9	.73½	" 10	.39	" 10	.53	" 9	.74½
" 16	.74	" 17	.39½	" 17	.53	" 16	.82½
" 23	.74	" 24	.40½	" 24	.51	" 23	.89
" 30	.67	May 1	.41½	" 31	.55	" 30	.92

Every poultryman knows that not all of the eggs laid by a flock of hens can be sent to market and that a certain percentage represent practically a total loss, even under the best conditions of care and management. For instance, blood clots

TABLE 18.

BLOOD CLOTS AND BLOODY EGGS—1917-1918.

Month	No. Bloody Eggs	Total Eggs	Per Cent Bloody
November	18	5179	.35%
December	33	7596	.43
January	35	8399	.42
February	128	11236	1.14
March	178	18005	.99
April	276	18206	1.52
May	166	20554	.81
June	106	17773	.60
July	110	16027	.69
August	56	15452	.36
September	38	13202	.29
October	48	7291	.66
Year	1192	158920	.75

and bloody eggs cause quite a distinct loss in the course of a year. Table 18 shows the number of such eggs found in candling during each month and the total for the year. As might be expected, the total number and also the per cent of such unmarketable eggs was greatest during, and in fact just a little in advance of, the season of highest egg production. To be sure, the total for the year amounted to but three-fourths of one per cent of all eggs, but from 1000 birds this means a total of 1192 eggs or very nearly 100 dozen. At the average price of 54.8 cents a dozen this means a net loss of $65.32 during the year. This is only one of the many relatively small factors of loss which are often overlooked in discussions of cost and profit.

WEIGHT AND VALUE OF EGGS.

In Table 19 are shown the number of birds in each of the principal breeds, together with the average yearly yield per bird, the total number of eggs produced by all birds in each breed, with their total value and the average value per dozen. As in previous years Wyandottes secured the highest figure for average value of eggs per dozen. It should be borne in mind that a part of this higher value is probably fictitious, owing to the fact that Wyandottes as a breed lay a larger proportion of small sized eggs, which must be sold at a lower price per dozen. It is only when we assume that all eggs are sold at the same price in any month provided they exceed the lower limit of weight, which has been set at .08 lb., that the Wyandottes exceed their competitors. The reason for this will be apparent from an inspection of the diagram mentioned in an earlier paragraph. During the months of December, January, September, and October, when prices are relatively high, the Wyandottes have managed to roll up a higher score of total eggs produced than have representatives of the other breeds involved.

In another table are indicated the total number of eggs produced each month by the 1000 birds, together with the price per dozen received during that month, and the total value of all eggs produced, assuming that all were marketable. The authors realize that this method of figuring results in a total value of eggs which is probably somewhat higher than would result if all eggs laid were actually marketed at the indicated prices. On the other hand, when one considers the conditions under which a laying contest must be conducted; namely, the fact that all eggs must be handled no less than seven or eight times between the time they are laid and the time they are actually en route for market, it will necessarily be conceded that the breakage which occurs will be considerably greater than would result in handling the same number of eggs under ordinary commercial conditions. At the same time the writers have no desire to cover up the fact that on any commercial plant there is always a distinct loss arising from the fact that a certain percentage of all eggs laid will be unmarketable, owing to such causes as blood clots, bloody eggs, cracked eggs, undersized and misshapen specimens.

It is decidedly interesting to note that the greatest returns were received in the month of August. The further fact that this condition has obtained in each of the competitions conducted at Storrs would seem to be especially significant. The fact that prices are steadily rising during this season would indicate that receipts of eggs at the wholesale markets are normally decreasing. Thus it appears that a poultryman

Barred Rocks, Record 2037 Eggs.

may be able to realize an exceptional profit if he can devise any method which will postpone the normal drop in egg production which his flock may be expected to make until a later season. In a previous report the authors have stated that in their opinion the type of house used in the contest, being high and well ventilated, tends to maintain a fairly comfortable temperature during the hot August nights and has, therefore, been an important factor in securing favorable egg yields at this season.

White Wyandottes, Record 2179 Eggs.

TABLE 19.

VALUE OF EGGS PER DOZEN

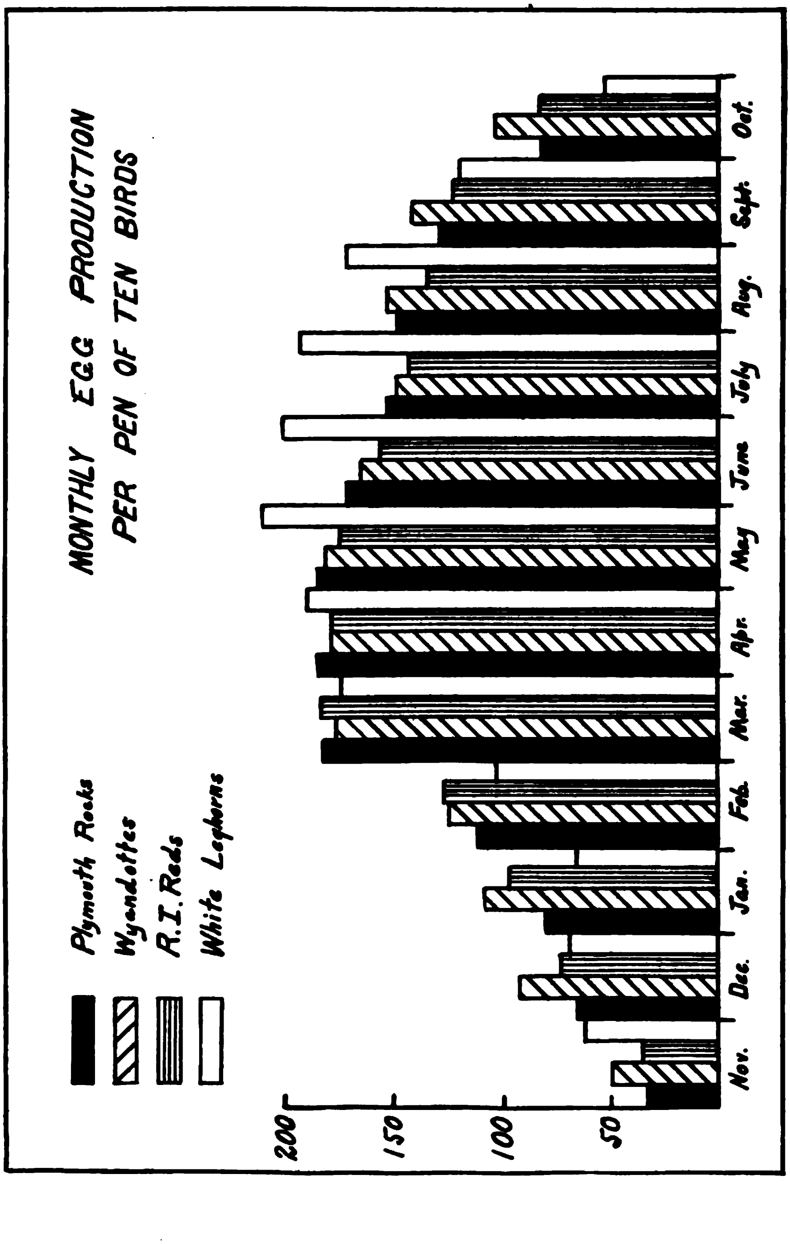
(Based on total number of eggs and total value)

BREED	Number of Birds	Eggs per Bird	Total Number of Eggs	Total Value	Value per Dozen
Plymouth Rocks	180	159.3	28,668	$1,312.10	54.9
Wyandottes	160	162.6	26,010	1,223.25	56.4
R. I. Reds	170	148.0	25,166	1,150.83	54.9
White Leghorns	430	162.8	69,849	3,160.33	54.3
Miscellaneous	60	153.7	9,227	417.28	54.3
All Breeds	1000	158.9	158,920	$7,263.79	54.8

VALUE OF EGGS BY MONTHS

Month	Eggs	Price per Doz.*	Value
November	5179	75.5c	$325.84
December	7596	69.5	439.95
January	8399	72.5	507.48
February	11236	59.5	557.03
March	18005	46.5	697.75
April	18206	39.5	599.34
May	20554	41.0	702.32
June	17773	47.0	696.21
July	16027	53.0	707.89
August	15452	63.0	811.23
September	13202	65.5	720.59
October	7291	82.0	498.16
Year	158,920	54.8c	$7,263.79

*Averaged to the nearest half cent.


MONTHLY EGG PRODUCTION
PER PEN OF TEN BIRDS
Plymouth Rocks
Wyandottes
R.I. Reds
White Leghorns
200
150
100
50
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.

MONTHLY EGG PRODUCTION.

Table 24 shows the monthly egg production of each of the 100 pens involved. Study of this table shows that there is great variation among different pens of the same variety in the rate of production during any month that may be selected. Not only this, but when one considers all breeds together it is entirely possible for two pens laying the same total number of eggs during the year to yield the bulk of their product at different seasons. A further interesting point is the actual high point of production reached in any single month by a pen of ten birds. In each of the past five years the high monthly record has been made by a pen of White Leghorns. The actual yields made were 258, 250, 254, 253, and 268 for the third, fourth, fifth, sixth, and seventh contests respectively.

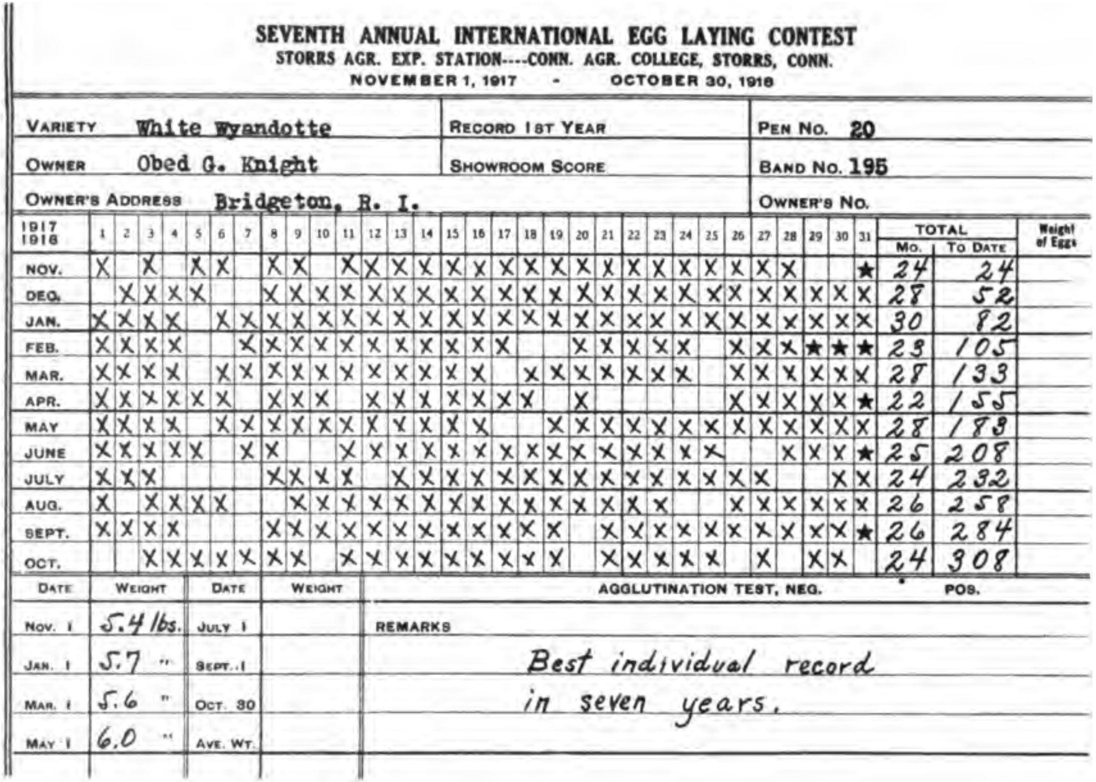
The monthly egg production figures have been averaged by breeds and brought together for easy comparison in Table 20. Plymouth Rocks exceeded the average for all breeds in six months out of the twelve. Wyandottes, Rhode Island Reds and Leghorns exceeed the same average in five, three and six months, respectively.

TABLE 20.

MONTHLY EGG PRODUCTION.

(Average per pen for the breeds indicated)

BREED	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Year
Plymouth Rocks	44	80	84	121	191	192	198	168	147	149	139	80	1593
Wyandottes	51	112	124	119	179	173	183	156	145	147	140	97	1626
R. I. Reds	32	70	79	118	181	175	180	162	139	141	125	78	1480
White Leghorns	65	66	71	105	177	185	226	197	180	166	130	60	1628
Miscellaneous	42	56	86	106	172	184	214	174	161	153	126	63	1537
All Breeds	52	76	84	112	180	182	206	178	160	154	132	73	1589



SEVENTH ANNUAL INTERNATIONAL EGG LAYING CONTEST

STORRS AGR. EXP. STATION----CONN. AGR. COLLEGE, STORRS, CONN.
NOVEMBER 1, 1917 - OCTOBER 30, 1918

VARIETY White Wyandotte	RECORD 1ST YEAR	PEN NO. 20
OWNER Obed G. Knight	SHOWROOM SCORE	BAND NO. 195
OWNER'S ADDRESS Bridgeton, R. I.		OWNER'S NO.

1917 1918	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL Mo.	TOTAL To Date	Weight of Eggs
NOV.	X		X		X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			★	24	24	
DEC.		X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	28	52	
JAN.	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	30	82	
FEB.	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X		X	X	X	★	★	★	23	105	
MAR.	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	28	133	
APR.	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X		X						X	X	X	X	X	★	22	155	
MAY	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	28	183	
JUNE	X	X	X	X	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	★	25	208	
JULY	X	X	X					X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	24	232	
AUG.	X		X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	26	258	
SEPT.	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	★	26	284	
OCT.			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X		X		X	X		24	308	

AGGLUTINATION TEST, NEG. • POS.

DATE	WEIGHT	DATE	WEIGHT
NOV. 1	5.4 lbs.	JULY 1	
JAN. 1	5.7 "	SEPT. 1	
MAR. 1	5.6 "	OCT. 30	
MAY 1	6.0 "	AVE. WT.	

REMARKS

Best individual record
in seven years.

COST OF FEED AND RETURNS FOR EGGS.

In view of the very high feed prices which have prevailed during the past two years, the information gathered in the laying contests with reference to the feed cost of egg production and returns for the eggs have been decidedly interesting. As would be expected, the total cost of feed and also the total returns for eggs have been considerably greater during the seventh contest than they were in previous years. It has also been true that the return above feed cost per pen of ten birds has been from $10 to $15 per pen greater than it was two years ago. It will thus be evident that feed cost alone need not cause a poultryman to go out of business. The last two tables in this bulletin show the amount and cost of feed consumed, the number of eggs produced, with their average weight and total value, and the returns above feed cost for each pen in the contest. These data have been summarized and averaged by breeds and in this form appear in Tables 21 and 22. The Plymouth Rocks consumed the greatest amount of feed per pen, while the Rhode Island Reds, Wyandottes, and Leghorns followed in the order named. In view of the fact that feed of poorer quality was used in the last contest, the figures expressing the relative efficiency of a pound of feed in producing eggs are decidedly interesting. The amount of feed (mash and grain) consumed for each pound of eggs laid was 5.21, 4.86, 5.27, and 4.40 lbs. respectively for the Rocks, Wyandottes, Reds, and Leghorns. In every case the consumption was greater than in the previous year when the corresponding figures were 4.87, 4.50, 4.64, and 4.15 lbs.

The cost of feed per dozen eggs (including grit, shell, and charcoal) was 20.9 cents for the Leghorns, 22.1 cents for the Wyandottes, 24.2 cents for the Plymouth Rocks, and 25.2 cents for the Rhode Island Reds. These figures also are somewhat in excess of the corresponding figures for the previous year. In computing the figures on feed cost which appear in the various

White Leghorns, Record 2043 Eggs.

tables the factors used represented the actual cost of each kind of feed delivered at the plant. These figures were, on the basis of 100 lbs. of each feed, $3.50 for grain, $2.80 for mash, 75 cents for oyster shell and grit, and $2 for charcoal. The cost of green food was not determined for each pen and consequently does not appear in the tables.

Oregons, Record 2352 Eggs.

SOME FIVE YEAR AVERAGES.

In Table 23 have been brought together for each of the four principal breeds the average pen figures for each of the past five years with respect to some fourteen different factors. The last column in this table represents in each case an average of the figures contained in the first five columns, thus giving each year equal weight in determining the average without regard to the actual number of birds involved in each case. The reason for using this basis was to prevent throwing the average cost of feed, for instance, too far toward a figure for any year in which a large number of pens of a given variety were entered. Among the outstanding features of the table may be mentioned a few which are of particular interest. In the first place, the value of eggs per pen of ten birds has shown a steady increase thruout the five year period. This is due chiefly to the fact that egg prices have been rising, altho of course there is some effect from the varying average egg production in different years. In the same manner the cost of feed has increased by something more than $1 per bird during the five year period. This is due very largely to the increasing cost of feed, as the amount actually consumed per pen has been fairly constant until the last year of the period. Returns above feed cost have increased about 100 per cent; that is to say, that after paying the cost of feed for a flock of hens the owner would have left about twice as much in 1917-18 as in 1913-14. This does not mean, however, that he would necessarily make twice as large a profit on the flock because other costs have increased in the meantime. The figures do indicate, however, unless these other costs have risen more rapidly than has the cost of feed, that with a given egg production the profits in 1917-18 should be greater than they were five years ago, provided this assumed egg production was sufficiently high to pay all costs and leave a profit in 1913-14.

The amount of feed required to produce a dozen eggs has not varied greatly in the five years except that the poor quality of feed used in 1917-18 has been responsible for a slight increase in this factor during that year. The cost of feed per dozen eggs has been higher in each of the past two years than

TABLE 21.

COST OF FEED.

Average per pen for the breeds indicated.

BREED	Mash Lbs.	Grain Lbs.	Grit Lbs.	Charcoal Lbs.	Oyster Shell Lbs.	Total Cost
Plymouth Rocks	623	411	8.1	1.8	24.9	$32.13
Wyandottes	554	405	7.1	1.6	24.3	29.96
R. I. Reds	584	411	6.9	1.6	24.2	31.02
White Leghorns	494	402	7.5	1.5	31.7	28.23
Miscellaneous	529	408	6.1	1.4	31.2	29.42
All Breeds	544	406	7.4	1.6	28.0	$29.76

TABLE 22.

RETURN ABOVE COST OF FEED.

Average per pen for the breeds indicated.

BREED	Eggs	Weight Eggs in Lbs.	Weight per Dozen in ounces	Value of Eggs	Cost of Feed	Return above Feed cost
Plymouth Rocks	1,593	198.37	23.9	$72.89	$32.13	$40.76
Wyandottes	1,626	197.49	23.3	76.45	29.96	46.59
R. I. Reds	1,480	188.84	24.5	67.70	31.03	36.67
White Leghorns	1,624	203.60	24.1	73.50	28.24	45.26
Miscellaneous	1,538	200.12	25.0	69.55	29.42	40.13
All Breeds	1,589	198.97	24.0	$72.64	$29.76	$42.88

in any of the three previous years. This increase may be attributed very largely to the rise in feed prices. On the other hand, the return above feed cost for each dozen eggs has shown an increase of very nearly 100 per cent during the five year period.

TABLE 23.

BREED COMPARISON BASED ON RESULTS OBTAINED DURING THE FIVE YEAR PERIOD 1913-1918.

		1913-14	1914-15	1915-16	1916-17	1917-18	5 Year Ave.
Egg Production per pen of 10 Birds	Plymouth Rocks	1401	1463	1604	1610	1593	1534
	Wyandottes	1531	1650	1696	1653	1626	1631
	R. I. Reds	1362	1558	1587	1583	1480	1514
	White Leghorns	1555	1581	1654	1675	1624	1618
Value of Eggs per pen of 10 Birds	Plymouth Rocks	$36.59	$38.76	$46.32	$61.72	$72.89	$51.26
	Wyandottes	41.94	45.99	49.82	64.39	76.45	55.72
	R. I. Reds	36.52	42.00	45.79	61.09	67.70	50.62
	White Leghorns	40.44	41.21	47.26	63.85	73.50	53.25
Feed Consumed per pen of 10 Birds		Mash Grain	Mash Grain	Mash Grain	Mash Grain	Mash Grain	Mash Grain
	Plymouth Rocks	398 485	490 437	540 478	527 465	623 411	516 455
	Wyandottes	427 455	391 437	439 473	461 447	554 405	454 443
	R. I. Reds	425 460	496 443	485 491	513 451	584 411	501 451
	White Leghorns	316 452	355 425	398 451	418 451	494 402	396 436
Cost of Feed per pen of 10 Birds	Plymouth Rocks	$18.85	$19.76	$20.72	$27.45	$32.13	$23.78
	Wyandottes	18.21	17.80	18.68	25.25	29.96	21.98
	R. I. Reds	18.02	19.89	19.93	26.70	31.08	23.11
	White Leghorns	16.07	16.68	17.48	24.46	28.24	20.59

Return above Feed Cost per pen of 10 Birds	Plymouth Rocks	$17.74	$19.00	$25.60	$34.27	$40.76	$27.47
	Wyandottes	23.73	28.19	31.14	39.09	46.59	33.75
	R. I. Reds	18.50	22.12	25.86	34.39	36.67	27.51
	White Leghorns	24.37	24.53	29.78	39.39	45.26	32.67
Value of Eggs per Dozen	Plymouth Rocks	31.3c	31.8c	34.6c	46.0c	54.9c	39.7c
	Wyandottes	32.9	33.3	35.3	46.7	56.4	40.9
	R. I. Reds	32.1	32.3	34.6	46.3	54.9	40.0
	White Leghorns	31.2	31.3	34.3	45.7	54.3	39.4
Amount of Feed per Dozen Eggs	Plymouth Rocks	7.56 lbs.	7.60 lbs.	7.62 lbs.	7.39 lbs.	7.79 lbs.	7.59 lbs.
	Wyandottes	6.91	6.02	6.45	6.60	7.08	6.61
	R. I. Reds	7.80	7.23	7.38	7.31	8.07	7.56
	White Leghorns	5.93	5.92	6.16	6.23	6.62	6.17
Cost of Feed per Dozen	Plymouth Rocks	16.1c	16.2c	15.5c	20.5c	24.2c	18.5c
	Wyandottes	14.3	12.9	13.2	18.3	22.1	16.2
	R. I. Reds	15.8	15.3	15.1	20.2	25.2	18.3
	White Leghorns	12.4	12.7	12.7	17.5	20.9	15.2
Return above Feed Cost per Dozen	Plymouth Rocks	15.2c	15.6c	19.1c	25.5c	30.7c	21.2c
	Wyandottes	18.6	20.4	22.1	28.4	34.3	24.8
	R. I. Reds	16.3	17.0	19.5	26.1	29.7	21.7
	White Leghorns	18.8	18.6	21.6	28.2	33.4	24.1

TABLE 23 (continued from p. 55)

		1913-14	1914-15	1915-16	1916-17	1917-18	5 year Ave.
Weight of Eggs per Dozen	Plymouth Rocks	25.4 oz.	25.0 oz.	26.4 oz.	24.3 oz.	23.9 oz.	25.0 oz.
	Wyandottes	23.7	23.5	23.5	23.4	23.8	23.5
	R. I. Reds	25.6	25.6	24.4	25.2	24.5	25.1
	White Leghorns	24.1	24.3	23.8	24.0	24.1	24.1
Pounds of Feed per Pound of Eggs	Plymouth Rocks	4.76 lbs.	4.88 lbs.	4.61 lbs.	4.87 lbs.	5.21 lbs.	4.87 lbs.
	Wyandottes	4.66	4.08	4.38	4.50	4.86	4.50
	R. I. Reds	4.87	4.54	4.65	4.64	5.27	4.79
	White Leghorns	3.94	3.90	4.14	4.15	4.40	4.11
Number of Eggs from 100 Lbs. of Feed	Plymouth Rocks	159	158	158	162	154	158
	Wyandottes	174	199	186	182	170	182
	R. I. Reds	154	166	163	164	149	159
	White Leghorns	202	203	195	193	181	195
Eggs Required From each Pen to Pay for Feed	Plymouth Rocks	723	746	719	716	702	721
	Wyandottes	664	641	635	649	637	645
	R. I. Reds	674	739	691	692	678	695
	White Leghorns	618	639	612	642	624	627
Value of Eggs From each Dollar spent for Feed	Plymouth Rocks	$1.94	$2.07	$2.24	$2.25	$2.27	$2.15
	Wyandottes	2.30	2.58	2.67	2.55	2.55	2.53
	R. I. Reds	2.03	2.11	2.30	2.29	2.18	2.18
	White Leghorns	2.52	2.47	2.70	2.61	2.60	2.58

R. I. Red No. 463
Record 249 Eggs.

Oregon No. 524
Record 272 Eggs.

The last three factors appearing in the table have been computed with an idea of securing such a basis of comparing the five years that the results of a comparison would not be materially influenced by either a rise in egg prices or the increase in cost of feed. One such factor is the number of eggs produced from each 100 lbs. of feed consumed. On the basis of the five year average this factor has been 158, 159, 182, and 195 for the Plymouth Rocks, Rhode Island Reds, Wyandottes,

Barred Rock No. 112
Record 264 Eggs.

White Wyandotte No. 195
Record 308 Eggs.

and White Leghorns respectively. In a similar manner the number of eggs required to pay for the feed for a pen of ten birds has been for the same breeds 721, 695, 645, and 627 respectively. It will thus be apparent that when one considers the returns from 100 lbs. of feed rather than the return per individual, Leghorns are exceptionally efficient in the matter of egg production. The last factor in the table was the value of eggs returned for each dollar spent for feed. This factor has been remarkably consistent one year with another when any breed is considered separately. Considering the five year average, Wyandottes and White Leghorns have been practically equal with $2.53 and $2.58 respectively. Likewise Plymouth Rocks and Rhode Island Reds have been very close together with $2.15 and $2.18 respectively.

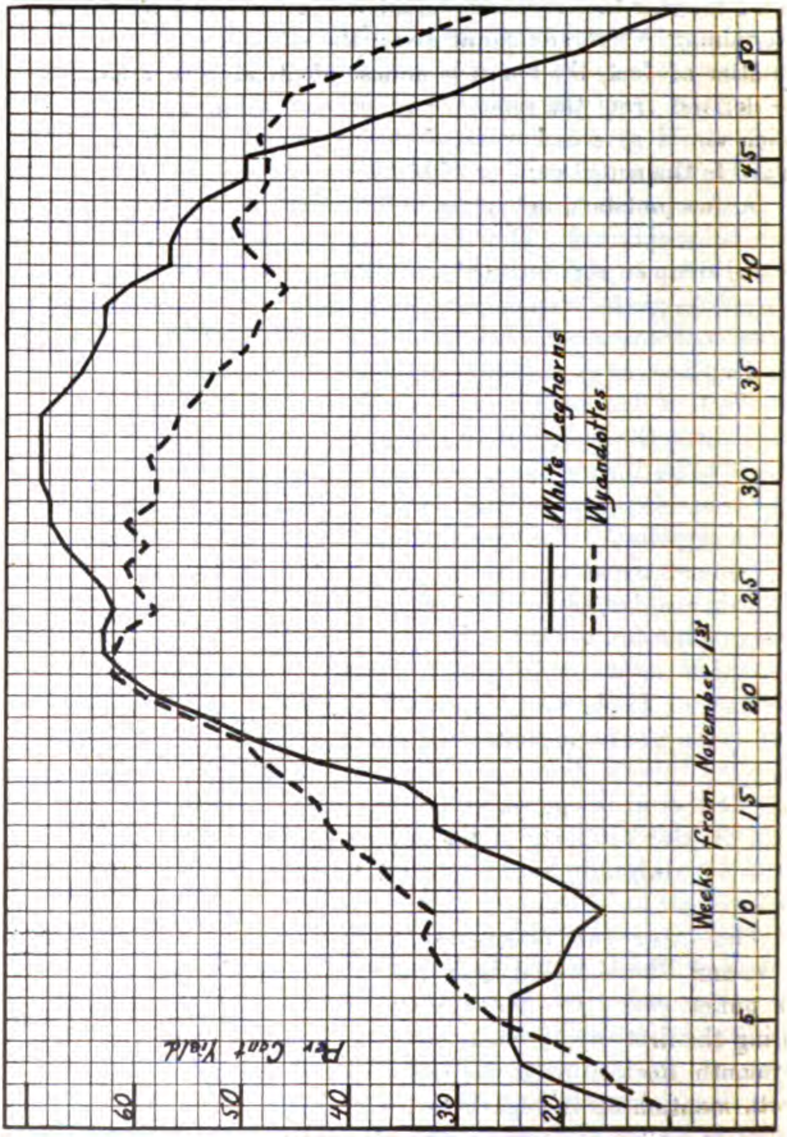
The authors desire to suggest that any poultryman may decidedly increase his chances for profit if he will record and later compute and study on the basis of a flock average such factors as are prepared in this table. If he will also include similar data relative to labor cost and the various other items of expense, there is absolutely no question about the fact that a reasonable amount of time so spent will bring in a much greater return than the same amount of time spent in other ways on the poultry plant.

CURVES OF WEEKLY EGG PRODUCTION

It is generally conceded that the rate at which a flock of hens lay at any given season bears a close relationship to the profits to be derived from the business. During the past five years a total of 4810 pullets have been trap-nested in the laying contests at Storrs. These have been distributed as follows: 750 Plymouth Rocks, 730 Wyandottes, 930 Rhode Island Reds, 1940 White Leghorns, and 460 miscellaneous breeds and varieties. This number of birds ought to be sufficient to give a curve of egg production closely approximating the normal which might be expected in the vicinity of Storrs when these breeds are handled under conditions similar to those employed in the laying contest. On the following pages are presented four such curves. They represent the percentage egg yield for each breed by weeks; or in other words, the number of eggs which might be expected daily in each week from a flock of 100 pullets in the breed concerned. In compiling the data on which these curves are based the records were combined in such a manner that each individual was given equal weight in determining where any point along the curve should lie. As a matter of fact, the curve is almost identical with a similar one derived from the same records when combined on a basis which would give each year of the five equal weight without regard to the actual number of birds involved.

A few outstanding points about these curves should perhaps be mentioned. The first point to be observed is the decided drop in egg production which the Leghorns have suffered from the sixth to the tenth week after the beginning of the contest. As has been pointed out in previous reports, this drop is very largely due to temperature. Combined with the effect of low temperature is also the fact that Leghorns which reach the competition in laying condition are practically certain to go thru a partial molt and thus suffer a setback in egg yield. Considering the breed as a whole, they make up for the eggs lost at this time by their higher production during the summer months. At the end of the laying year, when all birds are dropping off in egg yield, the Leghorns seem to have an ambition to be first in the matter of reaching minimum production. Almost in direct contrast to the seasonal performance of Leghorns is that of Wyandottes, and the Wyandotte curve has been plotted with that of Leghorns in order to bring out these differences. When the Leghorns are suffering their first drop in egg yield, the Wyandottes are outlaying all other breeds; similarly at the end of the year when the Leghorns are dropping rapidly, Wyandottes are at the head of the list.

The other two breeds represented, namely; Plymouth Rocks and Rhode Island Reds, run very close together thruout the pullet year. On the average the Reds have excelled during the first twenty weeks and have been led slightly by the Plymouth Rocks during the remainder of the year. A point worth mentioning in regard to the curves on these latter two breeds, as well as the curve representing Wyandotte production, is that the drop experienced in the thirty-ninth week was due chiefly to the hot wave of July 1917. The severity of this hot spell may be brought out by saying that there were over twenty deaths from heat prostration in a single day among the birds on the contest and college plants.


White Leghorns
Wyandottes
Per Cent Yield
20
30
40
50
60
Weeks from November 1st
5
10
15
20
25
30
35
40
45
50

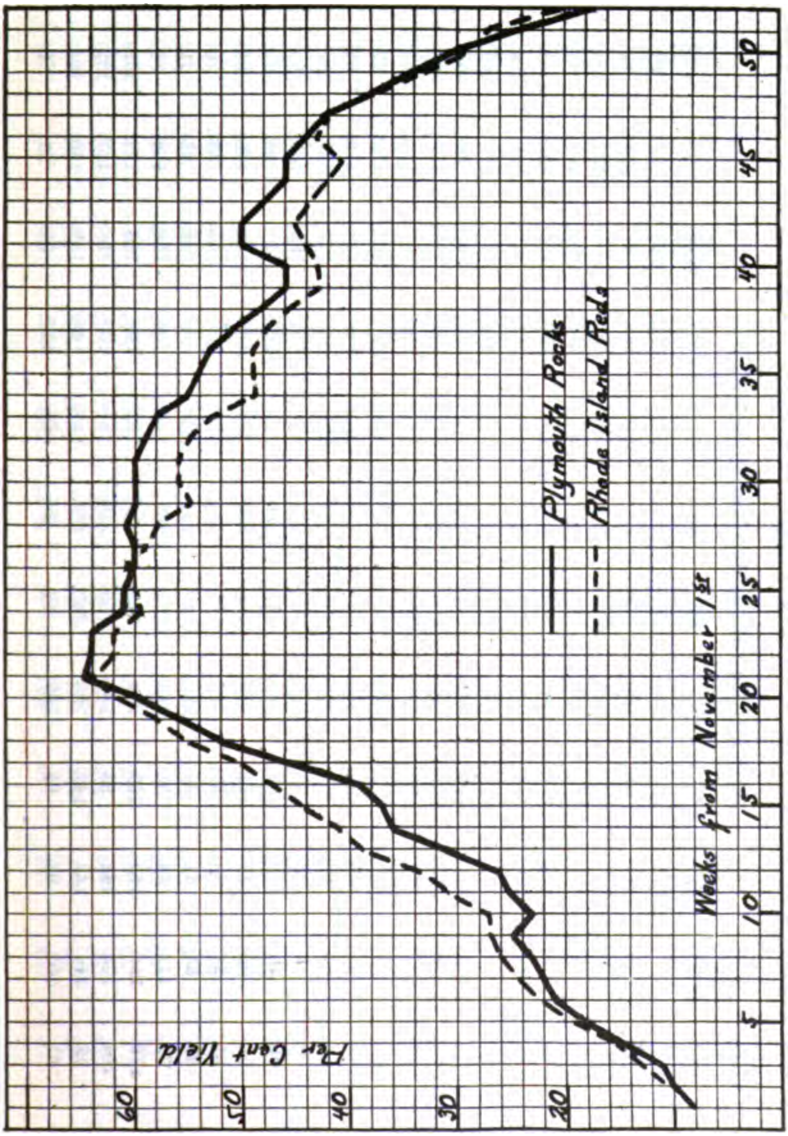

Per Cent Yield
60
50
40
30
20
Weeks from November 1st
5
10
15
20
25
30
35
40
45
50
Plymouth Rocks
Rhode Island Reds

TABLE 24.

MONTHLY EGG PRODUCTION BY PENS.

Pen	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Year
1	—	7	124	139	204	212	198	191	177	210	162	83	1707
2	72	73	47	84	196	193	177	124	96	67	116	54	1299
3	41	119	126	159	226	202	227	204	191	205	187	150	2037
4	113	196	51	163	224	215	221	204	172	126	141	55	1881
5	35	101	173	159	225	219	220	182	182	171	155	98	1920
6	22	70	130	131	175	189	169	169	154	137	163	112	1621
7	18	71	40	137	152	125	171	138	125	112	104	108	1301
8	44	129	116	123	165	189	143	135	120	119	84	65	1432
9	83	148	112	141	192	196	199	172	141	178	152	96	1810
10	45	107	67	107	221	202	180	164	96	168	135	75	1567
11	38	103	152	173	216	183	229	128	133	167	172	93	1787
12	44	66	96	132	218	224	251	209	209	180	170	82	1881
13	50	61	65	100	202	194	234	201	177	170	174	100	1728
14	—	5	12	39	172	237	242	188	154	136	132	64	1381
15	40	49	60	139	187	157	186	113	108	111	96	27	1273
16	57	50	43	111	175	185	202	201	177	163	125	86	1575
17	51	31	38	51	152	178	181	174	133	147	134	76	1346
18	35	51	61	96	135	149	141	129	99	112	95	19	1122
19	78	113	84	55	166	161	203	194	166	156	154	89	1619
20	116	158	163	169	216	211	227	202	194	180	184	159	2179
21	104	176	142	83	182	166	216	197	169	168	167	132	1902
22	18	144	148	142	190	207	179	137	148	149	160	124	1746
23	61	102	68	62	109	72	93	71	107	91	81	72	989

24	6	132	135	140	201	180	218	175	192	194	152	41	1766
25	22	72	141	127	127	180	166	156	118	122	125	108	1409
26	36	157	173	118	192	195	204	190	145	164	152	99	1825
27	5	70	148	165	202	203	219	185	187	160	171	116	1831
28	66	160	130	140	181	197	161	138	123	93	98	80	1567
29	4	24	109	145	216	187	128	133	132	128	114	73	1393
30	153	142	119	114	202	183	155	124	157	169	160	94	1772
31	3	60	110	105	138	147	136	126	87	96	122	59	1189
32	72	124	69	91	158	165	185	131	100	122	129	82	1428
33	65	117	153	116	175	182	245	191	162	158	153	106	1823
34	2	41	95	188	212	174	194	148	186	194	115	123	1572
35	32	55	29	97	149	109	133	114	60	113	75	61	1027
36	45	91	124	155	222	218	179	115	118	143	113	109	1632
37	78	153	3	52	138	120	108	167	127	114	129	81	1265
38	8	29	25	144	194	153	149	159	138	138	87	65	1284
39	—	13	58	180	197	141	226	191	148	164	176	98	1542
40	21	51	91	142	222	198	200	167	181	172	114	63	1622
41	19	44	82	97	185	214	193	164	144	123	144	107	1516
42	12	31	38	70	97	133	124	125	116	141	132	67	1086
43	135	155	69	126	180	177	214	185	161	151	148	103	1804
44	29	144	163	195	237	213	207	179	175	166	148	106	1962
45	—	18	94	154	170	189	213	187	185	171	171	111	1663
46	—	17	60	70	148	168	186	207	138	127	135	23	1279
47	35	93	150	130	202	177	203	162	109	135	93	34	1523
48	15	109	97	90	212	229	182	150	154	124	108	62	1532
49	99	46	56	104	162	167	171	169	144	170	138	71	1497

TABLE 24. (continued)

Pen	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Year
50	21	103	117	138	196	175	172	145	139	145	101	104	1556
51	1	45	90	107	168	187	192	174	131	104	111	66	1376
52	22	21	4	28	160	166	201	179	181	162	153	104	1381
53	140	123	132	146	183	223	266	245	249	249	219	177	2352
54	—	36	100	93	189	193	229	155	151	130	73	6	1355
55	75	60	102	123	158	141	165	119	120	104	90	31	1288
56	—	56	110	135	197	197	216	194	153	157	106	6	1527
57	17	43	66	109	147	186	205	151	114	118	116	52	1324
58	117	74	75	89	152	162	227	204	172	201	126	48	1647
59	128	147	79	139	187	185	242	226	221	220	158	98	2030
60	85	147	146	144	193	188	217	241	193	202	156	102	2014
61	90	68	79	105	147	152	200	183	148	185	140	33	1530
62	24	38	65	70	131	138	189	149	79	74	59	14	1030
63	60	73	56	100	200	184	224	207	204	160	149	63	1680
64	28	30	54	87	144	193	227	178	187	199	173	67	1567
65	103	68	33	117	193	216	226	187	223	190	137	63	1756
66	64	39	61	136	163	179	236	213	219	218	154	61	1743
67	81	94	97	121	169	200	228	212	203	153	135	64	1757
68	139	138	68	106	190	201	251	236	227	224	181	82	2043
69	11	71	86	112	171	191	236	194	225	195	166	36	1694
70	91	63	56	96	173	186	255	223	222	188	187	87	1827
71	133	85	25	97	214	198	229	221	216	170	134	91	1818
72	84	78	49	109	165	176	205	175	151	141	114	25	1472
73	9	63	206	186	224	199	247	101	187	202	206	108	1933
74	100	75	109	98	158	174	225	128	151	88	65	23	1384

75	35	96	101	138	204	183	216	198	151	54	80	70	1526
76	4	100	102	122	178	193	203	173	121	62	50	33	1341
77	10	20	81	117	160	167	223	200	181	173	117	26	1475
78	84	67	82	100	130	157	249	221	231	227	189	111	1848
79	58	90	104	147	205	191	226	217	159	191	142	35	1765
80	124	85	69	95	169	194	225	174	148	138	128	54	1603
81	145	96	60	134	173	187	179	215	205	187	161	143	1885
82	99	71	71	85	182	216	179	212	173	186	186	123	1783
83	35	73	87	114	216	243	268	194	160	162	148	62	1762
84	60	39	66	66	148	166	218	193	112	162	129	54	1413
85	83	46	39	53	175	201	233	226	216	192	146	32	1642
86	75	68	48	37	140	174	225	212	199	187	81	1	1447
87	104	122	78	120	190	205	250	225	226	206	165	109	2000
88	14	46	90	85	170	160	201	182	168	149	102	33	1400
89	46	79	43	51	135	149	228	201	201	194	128	49	1504
90	64	38	31	98	185	179	218	217	195	147	80	11	1463
91	53	41	42	96	167	186	230	204	177	144	118	51	1509
92	96	50	48	109	148	142	203	158	135	124	133	85	1431
93	21	21	55	69	176	182	238	205	115	153	126	55	1416
94	111	67	90	118	203	178	238	215	156	149	129	50	1704
95	—	20	50	83	178	159	218	171	172	170	107	82	1410
96	—	35	78	109	195	199	241	173	175	157	94	55	1511
97	18	47	33	109	199	187	239	217	182	147	110	72	1560
98	54	50	37	101	192	186	200	111	129	120	53	9	1242
99	29	12	62	129	193	199	240	231	213	178	148	86	1720
100	12	1	48	110	208	218	268	223	201	144	98	38	1569
Totals	5179	7596	8399	11236	18005	18206	20554	17773	16027	15452	13202	7291	158920

TABLE 25.

AMOUNT AND COST OF FEED CONSUMED.

Pen	Mash lbs.	Grain lbs.	Grit lbs.	Charcoal lbs.	Shell lbs.	Cost
1	648	410	7	2.1	27	$32.82
2	602	409	10	1.9	22	31.46
3	599	421	10	1.8	29	31.85
4	622	408	10	2.1	29	32.05
5	684	419	6	1.6	25	34.08
6	640	404	8	2.1	26	32.36
7	491	386	6	2.1	21	27.52
8	558	416	6	1.0	24	30.43
9	728	414	10	1.4	30	35.19
10	628	411	8	2.9	22	32.24
11	621	412	6	1.4	24	32.08
12	581	419	9	1.1	24	31.19
13	641	438	10	1.6	26	33.60
14	686	408	7	1.8	21	33.73
15	539	397	6	1.6	22	29.25
16	678	407	7	2.1	29	33.53
17	607	408	9	1.9	23	31.54
18	663	414	10	1.9	25	33.37
19	545	417	7	1.6	25	30.13
20	513	423	7	2.0	26	29.46
21	613	405	10	1.7	23	31.62
22	587	410	6	2.1	25	31.06
23	373	358	4	1.1	17	23.14
24	633	417	7	1.6	25	32.58
25	466	384	7	1.7	18	26.70
26	591	408	9	1.5	27	31.12
27	596	398	6	1.7	25	30.88
28	533	397	5	1.7	23	29.08
29	587	409	10	1.7	30	31.09
30	564	409	5	1.2	24	30.36
31	542	412	7	1.4	22	29.84
32	547	414	8	1.5	24	30.07
33	570	412	8	1.9	26	30.69
34	600	411	7	1.4	29	31.51
35	634	391	7	1.4	21	31.68
36	620	418	8	1.9	27	32.29
37	473	404	8	1.5	21	27.64
38	575	412	7	1.6	23	30.78
39	604	412	7	1.4	25	31.59
40	567	419	7	1.6	26	30.83
41	617	412	7	1.4	28	31.97
42	474	401	6	1.4	20	27.54
43	629	413	7	1.5	26	32.35
44	563	419	8	1.9	27	30.74
45	636	417	6	1.3	23	32.66
46	631	420	7	1.9	24	32.62
47	536	405	6	1.7	24	29.43
48	577	414	6	1.7	24	30.92
49	546	409	7	1.6	22	29.85
50	621	420	9	1.8	26	32.32

Pen	Mash lbs.	Grain lbs.	Grit lbs.	Charcoal lbs.	Shell lbs.	Cost
51	633	407	5	1.6	24	$32.23
52	455	401	7	1.5	25	27.05
53	570	442	6	1.2	36	31.78
54	528	393	6	1.3	31	28.83
55	587	414	8	1.8	34	31.28
56	592	403	5	1.4	32	30.98
57	445	395	5	1.2	29	26.58
58	490	397	5	1.7	33	27.98
59	579	402	5	1.3	32	30.60
60	507	398	4	1.3	32	28.43
61	462	388	4	1.7	32	26.82
62	418	370	5	1.7	28	24.95
63	481	398	5	1.1	37	27.74
64	422	388	4	1.2	31	25.68
65	473	411	4	1.0	33	27.90
66	471	398	4	1.4	35	27.45
67	545	414	5	1.4	34	30.08
68	644	423	5	1.5	36	33.16
69	516	401	6	1.4	34	28.85
70	548	426	4	1.5	33	30.57
71	526	418	5	1.2	35	29.69
72	452	401	6	1.5	32	27.02
73	433	415	4	1.2	32	26.93
74	405	384	5	1.6	31	25.09
75	404	388	4	1.2	31	25.18
76	408	382	3	1.5	30	25.07
77	475	420	5	1.4	31	28.31
78	503	401	4	1.2	34	28.43
79	471	418	10	1.9	29	28.15
80	481	414	10	1.9	29	28.30
81	492	439	10	1.6	31	29.47
82	525	416	10	1.7	31	29.60
83	482	367	10	1.6	30	26.69
84	520	408	11	1.4	29	29.18
85	557	402	10	1.4	31	30.02
86	479	395	11	1.5	30	27.59
87	514	393	10	1.4	31	28.51
88	464	371	10	1.4	26	26.28
89	493	407	12	1.6	32	28.40
90	528	416	10	1.4	34	29.72
91	485	399	10	1.6	31	27.90
92	534	403	10	1.4	31	29.38
93	506	409	12	1.4	31	28.83
94	585	406	10	1.4	32	30.93
95	450	406	10	1.3	30	27.15
96	428	376	10	1.3	30	25.47
97	518	410	10	1.3	31	29.20
98	488	397	10	1.9	31	27.89
99	549	418	11	1.4	34	30.37
100	523	405	10	1.9	33	29.18
Totals	54423	40624	736	156.5	2779	$2975.70

TABLE 26.

SUMMARY OF DATA ON EACH PEN.

Eggs	Wt. Eggs in lbs.	Wt. per Dozen in ounces	Value of Eggs	Cost of Feed	Return above cost of Feed
1707	236.60	26.6	$77.28	$32.82	$4[illegible].46
1299	167.75	24.8	58.40	31.46	2[illegible].94
2037	238.53	22.5	95.78	31.85	6[illegible].93
1881	229.75	23.5	86.60	32.05	54.55
1920	246.35	24.6	89.14	34.08	55.06
1621	212.02	25.1	75.70	32.36	4[illegible].34
1301	159.93	23.6	60.17	27.52	32.65
1432	180.12	24.2	66.71	30.43	36.28
1810	240.36	25.5	85.41	35.19	50.22
1567	178.86	21.9	71.72	32.24	39.48
1787	217.72	23.4	83.72	32.08	51.64
1881	231.82	23.7	85.08	31.19	53.89
1728	208.66	23.2	78.71	33.60	45.11
1381	184.80	25.7	58.56	33.73	24.83
1273	167.90	25.3	56.78	29.25	27.53
1575	195.96	23.9	71.31	33.53	37.78
1346	172.82	24.7	60.68	31.54	29.14
1122	150.81	25.8	50.35	33.37	16.98
1619	193.25	22.9	75.54	30.13	45.41
2179	271.46	23.9	104.59	29.46	75.13
1902	224.62	22.7	91.45	31.62	59.83
1746	224.52	24.7	82.67	31.05	51.62
989	114.39	22.2	48.33	23.14	25.19
1766	231.91	25.2	80.91	32.58	48.33
1409	165.36	22.5	66.83	26.70	40.13
1825	224.57	23.6	86.00	31.12	54.88
1881	213.28	22.4	84.64	30.88	53.76
1567	189.76	23.3	73.75	29.08	44.67
1393	172.46	23.8	63.29	31.09	32.20
1772	209.47	22.7	85.65	30.36	55.29
1189	142.79	23.1	54.88	29.84	25.04
1428	164.67	22.1	66.86	30.07	36.79
1823	216.45	22.8	85.53	30.69	54.84
1572	200.89	24.5	72.33	31.51	40.8[illegible]
1027	142.68	26.7	46.97	31.68	15.[illegible]
1632	201.73	23.7	76.01	32.29	43.72
1265	158.76	24.1	59.90	27.64	32.[illegible]6
1284	172.94	25.9	57.01	30.78	26.[illegible]3
1542	198.04	24.7	69.63	31.59	38.[illegible]4
1622	220.77	26.1	72.84	30.83	42.[illegible]1
1516	203.47	25.8	68.72	31.97	36.[illegible]5
1086	148.84	26.3	49.91	27.54	22.[illegible]7
1804	229.92	24.5	85.42	32.35	53.[illegible]7
1962	245.09	24.0	91.73	30.74	60.9[illegible]9
1663	224.13	25.9	75.83	32.66	43.1[illegible]7
1279	178.26	26.8	55.53	32.62	22.9[illegible]1
1523	194.65	24.5	69.35	29.43	39.9[illegible]2
1532	199.69	23.7	68.87	30.92	37.9[illegible]5
1497	185.96	23.9	69.38	29.85	39.[illegible]
1556	216.94	26.8	73.49	[illegible]	[illegible]

Pen	Eggs	Wt. Eggs in lbs.	Wt. per Dozen in ounces	Value of Eggs	Cost of Feed	Return above cost of Feed
51	1376	188.56	26.3	$61.29	$32.23	$29.06
52	1381	181.47	25.2	61.73	27.05	34.68
53	2352	287.61	23.5	112.38	31.78	80.60
54	1355	168.96	23.9	58.18	28.83	29.35
55	1288	176.77	26.4	59.31	31.28	28.03
56	1527	210.19	26.4	66.88	30.98	35.90
57	1324	175.75	25.5	58.80	26.58	32.22
58	1647	216.92	25.3	75.91	27.93	47.98
59	2030	259.98	24.6	95.31	30.60	64.71
60	2014	231.96	22.1	94.95	28.43	66.52
61	1530	187.24	23.5	70.42	26.82	43.60
62	1030	128.81	24.0	44.58	24.95	19.63
63	1680	210.76	24.1	75.76	27.74	48.02
64	1567	197.99	24.3	70.46	25.68	44.78
65	1756	227.06	24.8	79.45	27.90	51.55
66	1743	212.00	23.4	79.02	27.45	51.57
67	1757	222.05	24.3	80.36	30.08	50.28
68	2043	254.79	23.9	95.18	33.16	62.02
69	1694	215.80	24.5	75.83	28.85	46.98
70	1827	221.24	23.3	83.61	30.57	53.04
71	1813	230.05	24.4	82.89	29.69	53.20
72	1472	182.62	23.8	66.20	27.02	39.18
73	1933	222.93	22.1	90.67	26.93	63.74
74	1384	166.33	23.1	62.59	25.09	37.50
75	1526	180.12	22.7	68.43	25.18	43.25
76	1341	165.55	23.7	58.80	25.07	33.73
77	1475	192.06	25.0	64.87	28.31	36.56
78	1848	218.75	22.7	86.48	28.43	58.05
79	1765	219.14	23.8	80.07	28.15	51.92
80	1603	210.80	25.2	73.51	28.30	45.21
81	1885	239.22	24.4	89.78	29.47	60.31
82	1783	226.90	24.4	83.37	29.60	53.77
83	1762	229.11	25.0	78.37	26.69	51.68
84	1413	178.86	24.3	63.70	29.18	34.52
85	1642	210.97	24.7	72.86	30.02	42.84
86	1447	185.40	24.6	63.64	27.59	36.05
87	2000	246.74	23.7	92.99	28.51	64.48
88	1400	173.84	23.8	62.12	26.28	35.84
89	1504	181.81	23.2	67.80	28.40	39.40
90	1463	186.45	24.5	63.42	29.72	33.70
91	1509	188.11	23.9	66.74	27.90	38.84
92	1431	177.30	23.8	66.32	29.38	36.94
93	1416	182.38	24.7	62.00	28.83	33.17
94	1704	215.22	24.3	77.60	30.93	46.67
95	1410	184.42	25.1	62.54	27.15	35.39
96	1511	188.58	24.0	66.12	25.47	40.65
97	1560	206.28	25.4	68.46	29.20	39.26
98	1242	151.58	23.4	53.80	27.89	25.91
99	1720	224.79	25.1	76.66	30.37	46.29
100	1569	202.10	24.7	66.69	29.18	37.51
Totals	158920	19896.80	24.0	$7263.79	$2975.70	$4288.09

LIST OF ENTRIES.

BARRED ROCKS.

Pen	Owner and Address.
1	Merrit M. Clark, Brookfield Center, Conn.
2	Harry H. Ober, Lakewood, N. J.
3	Richard Allen, Pittsfield, Mass.
4	Jules F. Francais, W. Hampton Beach, L. I.
5	Tom J. Adamson, Laurel P. O., Quebec, Can.
6	Fairfields Poultry Farms, Short Falls, N. H.
7	Norfolk Specialty Farms, St. Williams, Ontario.
8	Rodman Schaff, Fitzwilliam, N. H.
9	Rock Rose Farm, Katonah, N. Y.
10	John C. Philips, Wenham, Mass.
11	Joseph M. Rothschild, Katonah, N. Y.
12	Ingleside Farm, Palenville, N. Y.
13	Agricultural College, Corvallis, Ore.

WHITE ROCKS.

Pen	Owner and Address.
14	Albert T. Lenzen, North Attleboro, Mass.
15	Holliston Hill Poultry Farm, Holliston, Mass.
16	S. Bradford Allyn, Belmont, Mass.
17	Manomet Farms, Plymouth, Mass.

BUFF ROCKS.

Pen	Owner and Address.
18	A. A. Hall, Danbury, Conn.

WHITE WYANDOTTES.

Pen	Owner and Address.
19	Merrythought Farm, Columbia, Conn.
20	Obed G. Knight, Bridgeton, R. I.
21	Brayman Farm, Westville, N. H.
22	Beulah Farm, Stoney Creek, Ontario.
23	Vine Hill Farm, Ipswich, Mass.
24	Mrs. R. W. Stevens, Stillwater, N. Y.
25	Woodland Poultry Yard, Wyncote, Pa.
26	F. W. Harris, Melrose, N. Y.
27	Laurel Hill Farm, Bridgeton, R. I.
28	J. Frank Dubois, East Lynn, Mass.

BUFF WYANDOTTES.

Pen	Owner and Address.
29	Fred Rockwood, So. Brookline, N. H.
30	Cook & Porter, Easthampton, Mass.
31	J. J. Dansro, North Clarendon, Vt.
32	Dr. N. W. Sanborn, Holden, Mass.
33	H. P. Cloyes, East Hartford, Conn.
34	H. R. Sullivan, Hartford, Conn.

RHODE ISLAND REDS.

Pen	Owner and Address.
35	Conyers Farm, Greenwich, Conn.
36	Chas. H. Lane, Southboro, Mass.
37	Flintstone Farm, Dalton, Mass.
38	Homer P. Deming, Winsted, Conn.
39	Charles O. Polhemus, Newburgh, N. Y.
40	Pequot Poultry Farm, Southport, Conn.
41	Springdale Poultry Farm, Durham, Conn.
42	Natick Farm, Natick, R. I.
43	Pinecrest Orchards, Groton, Mass.
44	Richard Allen, Pittsfield, Mass.
45	A. W. Rumery, Danville, N. H.
46	Archie R. Colburn, Hollis, N. H.
47	Allan's Hardtobeat Reds, Newport, R. I.
48	Deer Brook Poultry Farm, Short Falls, N. H.
49	W. Mansfield Poultry Farm, Attleboro, Mass.
50	Jacob E. Jansen, North Haven, Conn.
51	Etjon Poultry Farm, South Vineland, N. J.

BUTTERCUPS.

Pen	Owner and Address.
52	Hiddenhurst Buttercup Yards, Sharon Sta., N. Y.

OREGONS.

Pen	Owner and Address.
53	Agricultural College, Corvallis, Ore.

ORLOFFS.

Pen	Owner and Address.
54	W. H. Bassett, Cheshire, Conn.

WHITE ORPINGTONS.

Pen	Owner and Address.
55	Harry Paxton, Gloversville, N. Y.

BLUE ANDALUSIANS.

Pen	Owner and Address.
56	E. D. Bird, Greenwich, Conn.
57	Blue Andalusian Club of Am., Congers, N. Y.

WHITE LEGHORNS.

Pen	Owner and Address.
58	A. B. Hall, Wallingford, Conn.
59	Exmoor Farms, Lebanon, Pa.
60	J. O. LeFevre, New Paltz, N. Y.
61	Hermon E. White, Vineland, N. J.
62	Wm. L. Gilbert Home, Winsted, Conn.
63	Francis F. Lincoln, Mt. Carmel, Conn.
64	P. G. Platt, Wallingford, Pa.
65	Greendale Farms, Greendale, N. Y.
66	Dautrich Bros., Winsted, Conn.
67	B. S. Ells, Vineland, N. J.
68	Hollywood Farm, Hollywood, Wash.
69	Will Barron, Bartle, nr. Preston, England.
70	Tom Barron, Catforth, nr. Preston, England.
71	Miss N. H. Bell, Ightham, Kent, England.
72	Bushkill Poultry Farm, Bushkill, Pa.
73	A. P. Robinson, Calverton, N. Y.
74	Eglantine Farm, Greensboro, Md.
75	Bayville Farms, Bayville, N. J.
76	Margareta Poultry Farm, Rocky River, Ohio.
77	Lovell Gordon, Esperance, N. Y.
78	E. A. Ballard, Chestnut Hill, Pa.
79	W. E. Atkinson, Wallingford, Conn.
80	Hilltop Poultry Yards, Suffield, Conn.
81	J. Frank Dubois, East Lynn, Mass.
82	Clifford I. Stoddard, Woodbridge, Conn.
83	George Phillips, Seymour, Conn.
84	J. F. Crowley, Lynn, Mass.
85	M. T. Lindsay, Mattituck, N. Y.
86	H. E. Gates, Plantsville, Conn.
87	Oak Hill Estate, Uniontown, Pa.
88	Royal Farms, Inc., Amston, Conn.
89	Jas. F. Harrington, Hammonton, N. J.
90	W. B. Kieft, Springfield, Ill.
91	Windsweep Farm, Redding Ridge, Conn.
92	Prescott's Poultry Place, Cheshire, Conn.
93	W. J. Cocking, Vineland, N. J.
94	M. J. Quackenbush, Nutley, N. J.
95	Fredonia Farm, New Canaan, Conn.
96	Hillview Farm, Lincoln, Mo.
97	Conyers Farm, Greenwich, Conn.
98	Frances H. Mersereau, West Willington, Conn.
99	C. S. Greene, Lakewood, N. J.
100	Henry E. Heine, Lakewood, N. J.

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STORRS

Agricultural Experiment Station

STORRS, CONNECTICUT

BULLETIN 101, JANUARY, 1919

BACILLARY WHITE DIARRHEA OF YOUNG CHICKS—VII.

Ovarian Infection of the Adult Fowl and Transmission of the Disease Through the Oviduct.

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BACILLARY WHITE DIARRHEA—VII. OVARIAN INFECTION OF THE ADULT FOWL AND TRANSMISSION OF THE DISEASE THROUGH THE OVIDUCT.

LEO F. RETTGER WM. F. KIRKPATRICK LESLIE E. CARD

Since the early summer of 1909 the Storrs Experiment Station and the Bacteriology Department of the Sheffield Scientific School of Yale University have been engaged in a cooperative investigation of baccillary white diarrhea of young chicks. The results have been published from time to time in six different Station bulletins*, and are therefore too well known to be restated here.

The attempts of the Station during the past three years to prevent infection by the elimination of infected breeding stock were based upon the clearly demonstrated fact that white diarrhea commonly perpetuates itself in a flock by the so-called "cycle of infection" (See Bulletin 77). The most important point of attack in this cycle appeared to be the demonstration of ovarian infection in hens which are employed as breeders, and in their complete elimination. The agglutination test which has been employed for four years has served admirably as a means of locating the specific infection.

About 25,000 adult fowls have been subjected to the agglutination test as part of the present campaign waged against white diarrhea. The work of the first two years of the campaign is summarized as follows (See Bulletin 88):

Number of hens tested 21,317; per cent of infection 9.3.

Number of males tested 1,037; per cent of infection 2.1.

Range of infection, 0 to 56.3 per cent of flock.

Number of chicks hatched 166,460, or 56.7 per cent of all eggs set.

Mortality during first three weeks, 10.2 per cent.

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*Bulletins 60 (1909), 68 (1911), 74 (1912), 77 (1914), 85 (1915), and 88 (1916).

Thus far, comparatively few flocks of any size which have been tested were found to be free from ovarian infection. This is in all probability due to the fact that the owners had anticipated or by actual experience had been made to realize that their flocks were unsound, and that they wished to get rid of the individual reactors. It is equally important that flocks of fowls of all breeds which are apparently without taint be subjected to some accepted method of examination with the idea of establishing a large number of such flocks as are absolutely free from ovarian infection, and of distributing the stock over as wide a range of territory as possible. This is by far a safer and more certain method than the elimination of reacting hens from a flock, and breeding from the non-reactors.

The results accompanying our efforts to eradicate bacillary white diarrhea by the elimination of infected breeding hens have been most gratifying. The value of the present procedure is best seen in the breeding records of the first year or two following the tests, that is in the high percentage of chicks raised. In many instances the favorable results were permanent. It must be admitted that no method of diagnosis is free from error. In the first place, when hundreds of hens are bled and tested daily faulty labelling due to haste, temporary confusion, etc. are at times unavoidable.

One of the greatest obstacles to permanent removal of all sources of infection in a flock by a single agglutination test is the condition of progressive infection from bird to bird. This fact is borne in upon us more and more as our work progresses. The spreading of B. pullorum infection from one individual to another is not confined to small chicks, although it apparently ceases after the chicks have attained the age of three to four weeks. Maturing and adult hens are susceptible to infection from without. The rapidity with which infection spreads through an adult flock appears to vary with different flocks. While in some instances it is extremely slow or stationary, in others the rate of spread within a period of twelve to fifteen months may be twenty or even twenty-five per cent of the entire flock. In general, it may be said that the higher the rate of infection at the time of the first agglutination test the greater is the percentage increase immediately following the test. Furthermore, the larger the number of reactors as compared with the non-reactors the more liable are errors in technique and labelling to creep in. The most successful results obtained with the agglutination method and the elimination of reactors are to be expected, therefore, in flocks in which the proportion of reactors in the first test is very small, certainly not over ten per cent.

From the foregoing it must appear to the reader that one of the very important problems that have remained unsolved hitherto is prevention of the continued spread of ovarian infection through the breeding stock. A solution of this problem will be of inestimable value to us in our efforts to eradicate the disease.

EXPERIMENTAL OVIDUCT INFECTION AND PERMANENT LOCALIZATION OF BACTERIUM PULLORUM IN THE OVARY.

It has long been the writers' intention to make an experimental study of the rôle which the male bird may play in the transmission of ovarian infection from hen to hen, but no plan presented itself whereby such a study could be undertaken with any promise of success.

It has been found repeatedly that maturing or adult cocks which have been hatched and reared on poultry farms that are affected by bacillary white diarrhea may become reactors to the agglutination test, and that the reactions may be persistent or even permanent. On page 1 of this bulletin is given the number of males which were tested in 1915 and 1916, namely 1,037, and the per cent of infection, 2.1, as compared with 9.3 per cent for the hens which were examined in the same period. (See Bulletins 85 and 88). Of twenty-three reacting males which reacted to the agglutination test in 1915 eleven were killed and thoroughly examined for visible evidence of disease and for the presence of B. pullorum. In the testes of two of the males B. pullorum was found to be present in large numbers, and in pure culture. In four of the other reacting males the pericardial sac was decidedly abnormal and contained the same organism in pure condition. Though similar examinations were made at other times of the different organs of reacting males testicular infection was not observed, and the above two cases constituted the total number in at least fifty to fifty-five examinations of this sort.

It is safe to assume that testicular infection is too rare to play a significant part in the transmission of the disease from the male to the hens. What appears to be of vastly greater importance is the possibility of transmission of infection from hen to hen through the agency of the male as a passive carrier. An analogous situation exists in infectious abortion of cattle.

While the oviduct of a normal hen is free from invasion by extraneous organisms, and in fact is sterile, by virtue of the strong antiseptic and protective action of the freshly secreted egg white (See Bulletin 75), B. pullorum is more or less indifferent to this action, and without doubt may remain in the oviduct for a considerable period of time, or at least long enough to effect a general blood invasion and perhaps more or less direct entry into the ovary. Furthermore, it appears quite probable that B. pullorum is expelled from an infected ovary from time to time in appreciable numbers, especially when there is a rupture of one or more of the small infected ova, or their reabsorption.

The following experiments may throw some light on the question of infection of adult hens by or through the agency of the male. They present conclusive evidence, at least, that infection of the interior of the oviduct readily leads to permanent infection of the ovary. It is hoped that in the near future some method will be found whereby the question of transmission of the disease through the male may be definitely settled. As the results on ovarian infection are of considerable significance they are published in full at this time.

The first experiment was conducted in 1917, and extended over a period of five months. Eighty well matured Rhode Island Red pullets and two males of the same breed were selected from what appeared to be sound and uninfected stock. Preliminary to the actual experiments two sets of agglutinations tests were made with the blood of each of the birds, the first on February 23rd and the second one month later. In the first test three reactors were discovered, which were of course eliminated from the group. On second testing no positive reactions were obtained.

Immediately following the second test the hens were divided into four groups of eighteen each. A male was added to each of two of these groups. The four groups were housed permanently in separate houses that were large enough to accommodate them. These houses had been cleaned thoroughly and disinfected. The grouping was as follows:

House No. 1 Check lot, uninfected, without male.

House No. 2. Half (9) of the hens artificially infected, half uninfected. Without male.

House No. 3. Half of the hens artificially infected, the other half uninfected. With male No. 29572.

House No. 4. Half of the hens artificially infected, the other half left uninfected. With male No. 29574.

On April 11th the hens receiving oviduct injections of suspensions of B. pullorum were inoculated in the following manner. Broth cultures which had been incubated twenty-four to forty-eight hours at 37°C. were injected into the lower portion of the oviduct with the aid of an ordinary medicine dropper or pipette. The amount of material injected was 0.5 to 1.0 cubic centimeter. After some perseverance the injections were made with little difficulty. The organisms were introduced beyond the cloaca as far as possible. In most instances the material appeared to be retained during the period of immediate observation.

The same individuals were given a second inoculation in a similar manner on May 10th, 1918.

All of the groups were given the same usual feed and care. The houses were well aired and cleaned at frequent intervals. They were also well supplied with good litter.

Following the second inoculation three sets of agglutination tests were made. The results are presented in the following table.

TABLE I. SHOWING AGGLUTINATION RESULTS OF ARTIFICIAL INFECTION OF OVIDUCT WITH B. PULLORUM.

EXPERIMENT NO. I.

HOUSE No. 1.

Check Lot—Without Male.

Fowl No.	May 19	July 2	Aug. 10
3	0	0	0
5	0	0	0
11	0	0	0
13	0	0	0
16	—	0	0
23	0	0	0
25	0	0	0
30	0	0	0
31	0	0	0
54	0	—	—
56	0	0	0
57	0	0	0
61	0	0	0
66	0	0	0
68	—died		
74	0	0	—
81	0	0	0
82	0	0	0

HOUSE No. 2.

Mixed Lot—Without Male.
Artificially infected oviduct.

Fowl No.	May 19	July 2	Aug. 10
15	—Died		
22	+	—	—
26	+	+	+
32	+	0	0
37	—Lost		
43	0	0	0
47	+	+	+
67	+	+	?
73	+	+	?
Oviduct not artificially infected			
8	—Died		
14	—	0	0
24	0	0	0
29	0	0	0
49	Died, culture test negative		
59	0	0	0
63	0	—	—
70	0	—	—
76	0	0	0

HOUSE No. 3.

Mixed Lot—With Male.
Artificially infected oviduct.

Fowl No.	May 19	July 2	Aug. 10
1	+	?	?
4	+	+	+
28	+	+	+
38	0	0	0
42	Died		
44	+	+	+
50	Died, culture test negative.		
51	+	?	?
58	+	+	+
Oviduct not artificially infected			
6	0	0	0
7	0	0	0
17	0	0	0
33	0	0	0
46	—	0	0
62	0	0	0
65	0	0	0
75	0	0	0
78	0	0	0
Male 29572	+	—	?

HOUSE No. 4.

Mixed Lot—With Male.
Artificially infected oviduct.

Fowl No.	May 19	July 2	Aug. 10
2	+	+	+
16	+	—	0
19	+	0	Died
27	Died		
35	+	?	—
36	+	0	?
53	+	+	—
71	+	+	0
79	Died, culture test positive		
Oviduct not artificially infected			
9	0	0	0
10	0	0	0
12	0	0	0
20	Out		
39	—	?	+
45	Died, culture test negative		
55	0	0	0
60	Out		
64	0	0	0
Male 29574	0	0	0

The above table requires little comment. The quick and almost general response by agglutination to the artificial infection of the oviduct was a matter of surprise to the authors. That some of the reactions should weaken with time was to be expected. In one instance at least general infection and death were brought about (Hen No. 79).

With a single exception, none of the hens which did not receive the oviduct injection of Bacterium pullorum reacted to the agglutination tests. No. 39 which was in the untreated lot in House 4 gave a questionable reaction on July 2nd. Five weeks later the reactions in both serum dilutions (1:50 and 1:100) were positive. Examinations of the ovary failed to reveal any infection with B. pullorum, however.

As House 4 had been supplied from the beginning of the experiment with a male, there is the possibility that the infection in this isolated case was carried by the male from an inoculated to the originally uninoculated hen. The male did not react in any of the three tests; hence it must have served as a passive carrier if it was at all responsible for the infection of hen No. 39.

It should be noted too that male No. 29572 in House 3 was a positive reactor at the time of the first agglutination test, May 19th. No test was made the following month, but two months after the first blood examination the reaction was questionable. No signs of infection were apparent when the male was killed in September and thoroughly examined. This acquiring of at least temporary infection is in harmony with other observations made in our routine serological tests covering the past three years, when infection was transmitted apparently from reacting hens to males which had been non-reactors hitherto. This question of transmitted infection from the hen to the male requires further investigation before definite conclusions can be drawn.

On September 13th, five months after the oviducts were first artificially infected, the surviving hens were killed and a thorough examination of the ovaries made. Of the fifty-one ovaries examined but two appeared abnormal, namely those of hens No. 58 and No. 73. In hen No. 58 the ovary was well developed. The yolks or developing ova were of various sizes. There were four or five small, discolored, misshapen ova that presented the characteristic appearance of typical white diarrhea ova. These were found to contain Bacterium pullorum.

The ovary of hen No. 73 contained several abnormal ova which were small and atypical. B. pullorum could not be found in these ova. The ovary as a whole was undeveloped. A large per cent of all of the ovaries from the fifty-one hens were small and undeveloped at the time of examination. They were from hens that had been very poor layers or which were well past their first laying season.

As the oviduct inoculation was carried out quite late in the laying season, namely April 11th and May 10th, it is possible that the small per cent of cases of ovarian infection may be due to the fact that the hens had passed the height of the laying season and that the ovaries were not as susceptible to infection with Bacterium pullorum as when they are more active. In the Futhermore, the brief time elapsing between the inoculation of the oviducts and the examination of the ovaries (five months) may also have tended to reduce the ratio of positive findings. second experiment these points were taken into consideration.

EXPERIMENT II ON OVIDUCT INFECTION.

In the fall of 1917 sixty White Leghorn pullets were selected. They were placed in three different houses, twenty in each house.

House No. 1. Half of the pullets were artificially infected in the oviduct. Remaining ten untreated. Without male.

House No. 2. Same plan as in No. 1, except that late in the course of the experiment a male was added to this lot.

House No. 3. Check lot. Uninoculated.

Broth cultures of B. pullorum (three different strains) forty-eight hours old were introduced into the lower end of the oviduct. The mixed antigen was diluted with an equal volume of physiological saline solution, and 0.5 to 1.0 cc. of the material injected with a medicine dropper. These injections were made on January 12th, 1918, five weeks after the pullets had been subjected to the customary agglutination test and all of the birds had been found to be non-reactors.

Following the oviduct infection all of the pullets in the three houses were bled twice from the wing vein, and the blood samples tested by the agglutination method, namely on February 14th and April 5th, in addition to the final test at the time of killing.

All of the birds were killed on August 27th, when a third agglutination test was made and the ovaries and other organs and tissues were subjected to thorough examination.

All of the houses were without a male until April 17th, 1918, when male No. 1342 was placed in House No. 2.

The results of Experiment II are set forth clearly in the following table.

TABLE II. SHOWING RESULTS OF ARTIFICIAL INFECTION OF OVIDUCT WITH B. PULLORUM

EXPERIMENT No. II.

HOUSE No. 1.

	Agglutination reaction				Condition of ovary
Fowl No.	Dec. 6	Feb. 14	Apr. 5	Aug. 27	Aug. 27
Artificial infection of oviduct—					
1	0	+	+	+	+
2	0	+	+	+	+
4	0	0	—	—	—
5	0	+	—	—	—
6	0	+	+	—	—
7	0	+	?	0	0
10	0	+	+	+	+
13	0	+	+	+	+
18	0	0	0	?	0
20	0	+	—	0	0
Without artifiicial infection—					
3	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	—	—
16	0	0	0	0	0
17	0	0	0	0	0
19	0	0	0	0	0

Note-In the last column + indicates abnormal ovary, B. pullorum present.

HOUSE No. 2.

	Agglutination reaction				Condition of ovary
Fowl No.	Dec. 6	Feb. 14	Apr. 5	Aug. 27	Aug. 27
Artificial infection of oviduct—					
21	0	0	0	0	0
22	0	+	+	0	0
23	0	0	0	0	0
25	0	0	0	0	0
26	0	0	+	+	+
27	0	+	—	—	—
32	0	0	0	0	0
34	0	0	0	0	0
37	0	0	0	0	0
38	0	0	+	0	0
Not artificially infected—					
24	0	0	0	0	0
28	0	0	0	—	—
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
33	0	0	0	0	0
35	0	0	0	0	0
36	0	0	—	—	—
39	0	0	0	—	—
40	0	0	0	—	—

Male No. 1342 placed in house on April 17.

Blood test on Aug. 27 negative. No evidence of infection found.

HOUSE No. 3.

Check lot, not artificially infected.

	Agglutination reaction				Condition of ovary
Fowl No.	Dec. 6	Feb. 14	Apr. 5	Aug. 27	Aug. 27
41	0	0	—	—	—
42	0	0	0	0	0
43	0	0	0	0	0
44	0	0	0	0	0
45	0	0	0	—	—
46	0	0	0	0	0
47	0	0	0	0	0
48	0	0	0	0	0
49	0	0	0	0	0
50	0	0	0	0	0
51	0	0	0	0	0
52	0	0	0	0	0
53	0	0	0	0	0
54	0	0	0	0	0
55	0	0	0	—	—
56	0	0	0	—	—
57	0	0	0	0	0
58	0	0	0	—	—
59	0	0	0	0	0
60	0	0	0	0	0

The results of experiment II are conclusive, so far as they go, and are full of suggestion. While the per cent of positive reactors to the agglutination test is much smaller than in experiment I, the relative number of permanently infected hens is much larger. If the same amount of undiluted B. pullorum broth culture had been injected in the second as in the first investigation it is quite probable that the number of reactors in table II would be largely increased. As it is, twenty-five per cent of the hens which were subjected to oviduct inoculation became permanent reactors, and on examination of the different organs and tissues at the completion of the experiment were found to possess abnormal ova which had every indication of being infected, and from which B. pullorum was recovered with ease.

The negative results of all agglutination tests and ovarian examinations of the hens in the check lot (3) and of those which were associated with the inoculated hens in houses 1 and 2 are of much significance. The latter indicate strongly that the transmission of infection from hen to hen through infected litter and by ordinary contact and association is rare, if indeed it takes place at all; for it is quite certain that infection of litter and food did occur for some time after the broth culture of B. pullorum was injected into the oviduct. Indeed this could actually be observed immediately following the inoculation, the culture not being completely retained in the oviduct and cloaca.

As the male which was placed in House 2 was not added to this group until three months after the artificial inoculation, and at a time when the danger of transmission was least, this part of the experiment is considered of little importance. In future investigations special emphasis will be placed upon this phase of the problem.

Both experiments have most conclusively shown that infection of pullets and fully mature hens may be brought about readily by infection of the cloaca and lower end of the oviduct. It has not as yet been demonstrated that the male plays a part in the transmission of the infecting organism from the cloaca and oviduct of hens that are permanent carriers of the disease organism to hens that have hitherto been free from the disease. Circumstantial evidence is such, however, that this method of transmission can hardly be doubted any more, and in the future the possibility of such infection should be reduced to the minimum. This may be done by segregating the males during the greater part of the year and allowing them to run with the females during the breeding season only.

Many poultry raisers resort to this measure of segregation from time to time, for various reasons. In the international egg laying contest at Storrs as well as elsewhere males are wholly excluded from the grounds. The absence of the males does not in the least affect the laying qualities of the hens, even over long periods of time. It is claimed that infertile eggs have better keeping qualities than the fertile. Furthermore, segregation, at least for a time, will tend to increase, rather than decrease the vitality of both sexes.

From the information which the present investigation has thus far furnished, and because of the certainty that segregation can in no way be harmful, separation of the two sexes should be practiced, except in the breeding seasons. The cooperation of owners throughout the state is sought in this matter, and in our continued effort to eliminate infected breeding stock by the method followed in the past three years this added measure may and should have a far-reaching influence in speeding along the complete eradication of white diarrhea.

CONCLUSIONS.

Progressive infection in a flock of chickens is not confined to young chicks, but also takes place in adult fowls, particularly the females. This tendency to increased infection in mature breeding stock is, beyond all doubt, one of the chief obstacles to rapid and complete eradication of bacillary white diarrhea.

The agglutination test as conducted in the past three years is one of the most important instruments whereby this disease can be curbed and eventually stricken from the list of destructive poultry ailments.

The introduction of the organism of bacillary white diarrhea into the cloaca and oviduct of laying hens may readily lead to permanent ovarian infection and thus be an important means of spreading the disease in the adult stock. It has not been demonstrated as yet that the male plays the important rôle of transmitting the infection from infected to hitherto sound hens, but the circumstantial evidence is such that transmission through this agency can no longer be doubted. The probability of oviduct infection being brought about in any other way, as for example through infected litter, appears quite remote.

As a practical means of preventing the spread of B. pullorum infection from hen to hen, and thus making the disease as it affects adults stationary within the flock, males should not be allowed to run with the females except during the breeding season. The adoption of this policy can work no injury, and may contribute very much to the ultimate elimination of bacillary white diarrhea. A trial period of a year or two should suffice to enable us to determine the full value of the plan.

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EXPERIMENTS IN CALF FEEDING: CORN SILAGE; WHOLE MILK DILUTIONS.

G. C. White
AND
J. A. Kuelling

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CALF FEEDING EXPERIMENTS: CORN SILAGE; WHOLE MILK DILUTIONS.

G. C. White and J. A. Kuelling.

INTRODUCTION.

There has been a steady decline in the number of dairy cattle in New England for more than a decade. This has been most marked in communities formerly producing butter, where there was a plentiful supply of skimmilk for calf feeding. The falling off in butter making, especially in the southern portion where the dense population daily consumes most of the available product, has resulted in a great decrease in the number of dairy stock raised. It has been considered too expensive to raise heifers for the maintenance of herds, and at last an acute situation has arisen due to the scarcity and extremely high prices of dairy cattle. After the outbreak of the war, more attention was given to calf raising as was shown by a survey in May, 1917[1] in which an increase for the year of 6.7% was found in the number of heifers between the ages of six months and the freshening period.

Need of Experimental Evidence.

On account of the extent to which corn silage is found on farms, as well as its relative economy as a feed, there is a growing tendency to use it in raising calves and heifers. At the same time, because of little or no experimental evidence in print regarding its use for calves, there is nothing definite as to its value for this purpose. In recent years, a number of observers have endorsed it with a caution against its too early or liberal use. Otis[2] states: "Corn Silage is also proving an excellent roughage for calves. It is usually safe to give the calf all the roughage it will eat." Brainard and Davis[3] make this statement: "Calves may be fed silage as soon as they are old enough to eat it. It is perhaps of greater importance that the silage be free from mold or decay when given to calves than when given to mature stock. They may be given at all times all the silage they will eat up clean; yearling calves will consume about 15 to 20 or more pounds per day. When supplemented with some leguminous hay, little if any grain will be required to keep them in a thrifty growing condition." Woll[4] says: "Corn silage of good quality made from at least nearly mature corn and free from mold may be fed to advantage in small quantities, say about 2 pounds per day to calves that are old enough to eat it. Older calves may be fed 5 to 10 pounds with dry feed." Henry and Morrison[5] make similar statements concerning its use. Larsen and Putney[6] recommend feeding lightly at first and up to six months of age three to five pounds per day. Hunziker and Caldwell[7] fed three groups of calves, containing ten calves per group, on rations in which corn silage was included. In a few cases. silage was given as early as the third week when the consumption was a trifle over 0.1 pound per day; but in general, silage was not eaten until they had reached about two months of age. The amount fed throughout was quite limited, averaging between 0.21 pound and 0.33 pound per head per day for six months. Silage was never fed to individuals at the rate of more than a pound a day and very little attention was given to it in the discussion. Since corn silage is available upon so many farms and is ever increasing in importance, it is necessary to know the amount that may safely be fed and at what age it should constitute a part of the calf ration.

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[1] Musser, K. B., White, G. C., McDonald, B. A., and Judkins, H. F., "Studies from the Survey on the Cost of Milk Production," Extension Bulletin No. 7, July, 1917, P. 17.

[2] Otis, D. H., "The Dairy Calf at Meal Time," Wis. Exp. Station Bulletin No. 192, 1910.

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[3] Brainard, W. K. and Davis, H. P., "Feeding and Management of Dairy Calves and Young Dairy Stock," Farmers' Bul. No. 777, U. S. D. A., 1917.

[4] Woll, F. W., "Productive Feeding of Farm Animals," 1915.

[5] Henry, W. A. and Morrison, F. B., "Feeds and Feeding, 15th Edition," 1915.

[6] Larsen, C. W. and Putney, F. S., "Dairy Cattle Feeding and Management," 1917.

[7] Hunziker, O. F. and Caldwell, R. E., "Skim Milk and Milk Substitutes for Calf Feeding." Purdue University Exp. Sta. Bul. No. 193, 1916.

The practical phases of raising calves on skimmilk and the proper supplements to use have been quite well determined. Several attempts have been made to find satisfactory milk substitutes for use in herds where skimmilk is not available, and a number of commercial products have been put on the market. It is safe to say that in practically all cases these substitutes are more costly, more troublesome to feed and produce less satisfactory gains than skimmilk. Recent investigations in nutrition place so much emphasis upon the vital growth producing vitamines of milk that it is not at all surprising that substitutes are invariably inferior to milk diets. While skimmilk gives satisfactory results, it is a considerable item of expense in the market milk herd and involves labor to separate especially for calf feeding, and may also necessitate marketing the dairy product both in the form of whole milk and cream, or butter. Since properties essential for growth are abundant in butter fat, it would seem logical that some use should be made of this constituent of milk during the first few weeks or months of the calf's life. No data are available concerning the use of whole milk in limited quantities during the entire first six months of feeding the calf. Frazer and Brand [8] conducted scme tests with three lots of calves to determine the minimum amount of milk required to raise a calf. They found that calves could be raised fairly well on 150 pounds of whole milk and 300 to 500 pounds of skimmilk when the feeding of milk continued from two to three months. The gains were fairly satisfactory but to discontinue the useof milk at so early an age in the hands of the majority of feeders would be hazardous. It is safer and better not to compel calves to subsist entirely on dry grain or roughage or even a milk substitute under the age of five or six months, because even tho they may live they will usually be unthrifty for weeks after, perhaps until put on pasture, and even then undersized animals may result. This is not only discouraging to the owner, but is disastrous in the sale of young stock. and even curtails the sale of the mature cows. It may later result in failure of the animals to attain the full powers of their heritage.

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[8] Fraser, W. J. and Brand. R. E., "Milk Required to Raise a Dairy Calf." Ill. Exp. Sta. Bul. No. 164 (1913).

PURPOSE OF THE INVESTIGATION.

There is a vital need for a simple and economical ration that will produce good results when raising calves under the existing conditions. To aid in finding such a ration is the purpose of these experiments which may be briefly outlined as follows:

I. The Use of Corn Silage:
   1. To determine the age at which it can first be fed.
   2. To determine the amount to feed up to 6 months of age.
   3. To determine its effect with different types of rations.
   4. To determine the gain and cost with and without silage.

II. The Use of Diluted Whole Milk:
   1. To determine a satisfactory and economical dilution for producing calves in a market milk herd.

PLAN OF THE EXPERIMENTS.

The experiments extended over a period of 28 months from the first of May, 1915 to the 31st of July, 1917. Thirty-two calves are included in the experiment. In all, there were 12 groups, with three calves in each of 6 groups, four calves in 3 groups, and two calves in 1 group. Four groups were started together at the beginning and the other groups were formed as satisfactory calves became available and facilities permitted. It was attempted to maintain the same conditions and surroundings for each group and they were under experiment for approximately 180 days each. This investigation deals with four types of rations, viz.:

1. Corn silage fed with a normal skimmilk ration.
2. Milk substitute and corn silage with grain and hay as in 1.
3. Diluted whole milk with grain and hay.
4. Diluted whole milk with grain, hay and silage.

The groups are small but many were practically duplicate experiments with small variations. It was planned to have each group balanced from the standpoint of size and vigor of calves, and in the groups containing three calves, a Jersey and a Guernsey (or two of the same breed) were put in with a Holstein or an Ayrshire when possible. Three Shorthorns were also used in the experiment.

The basal grain ration at the start consisted of 2 parts corn meal, 2 parts crushed oats and 1 part wheat bran. On account of the difficulty in obtaining corn meal at all times and, since it would not keep well over long periods, hominy was substituted in 1916. Special grain rations that were used are discussed under the respective group in which it was fed. All the calves in the same group were generally fed together and group records taken. Grain was weighed into a pail marked by the group number and the amount recorded on a sheet arranged for the purpose; the group was fed from this pail until the supply was exhausted, when another quantity was weighed out from the general supply. The grain was kept in a protected place.

The hay was usually mixed grasses with some clover or alfalfa. Because of the length of the period covered, the hay necessarily varied somewhat in quality. A supply was weighed out in bags and as in the case of grain, calves in the same group were fed collectively.

The Silage was taken fresh from the silage truck or from the silo at each feeding. No moldy or spoiled silage was fed. A supply was available thruout, altho there occurred a short period, in the case of some groups, when the corn was unfermented directly after filling the silos. No care was taken to remove butts or cobs.

The milk was fed fresh, even in the case of skimmilk, and the amount weighed and recorded for each individual calf. Colostrum milk was allowed at first, and later mixed herd milk. The amount of whole milk did not exceed 12 pounds per day and was fed from two to four weeks as explained under each group.

The standard amount of skimmilk or diluted milk when on full feed was 14 pounds. Skimmilk was separated from the mixed herd milk soon after milking by a power separator and fed at 90° to 100°F. It was necessary to change feeders occasionally altho the same herdsman was retained thruout.

Water was available for each group.

Pails and utensils in which milk was fed were washed after each feedng and steamed at least once, sometimes twice, daily.

Weights of all calves on experiment were taken on a pair of bullock scales weekly. With few exceptions, the weights were taken on the same day and at the same hour each week.

Refuse was weighed and recorded on the feed sheet whenever any group left a weighable amount. This was removed before the next feeding period.

The pens were light, airy and comfortable, altho at times somewhat crowded. Whenever the weather permitted, the calves were allowed to run in a dry lot, but were not allowed access to feed. Shavings were used for bedding and the pens cleaned daily except in unusual cases.

RESULTS WITH SILAGE AND SKIMMILK RATIONS.

In the beginning there were four groups numbered from 1 to 4. Of these, the check group received the standard ration of skimmilk, hay, and the basal grain ration. The object was to obtain a comparison on gains under our conditions with similar rations at other experiment stations, and to compare the cost of and gains with such a ration with those of the experimental rations. Group 4, which is a milk dilution group, did not receive silage and is eliminated from the discussion at present. Group 5 which was run later (in early 1916) is considered here. The makeup of these groups is given in Table I.

TABLE I.

MAKEUP OF SILAGE AND SKIMMILK GROUPS.

Calf No.	Breed	Sex	Date of Birth	Initial Weight (Lbs.)	Group and Ration
205	Holstein	Male	5/1/15	111	1—Silage skimmilk grain, hay.
401	Jersey	Male	5/2/15	61	
421	Jersey	Female	4/25/15	60	
25	Ayshire	Male	4/11/15	85	2—Silage and skimmilk alone.
103	Guernsey	Male	4/8/15	86	
108	Guernsey	Male	5/2/15	68	
105	Guernsey	Male	5/1/15	61.5	3—Skimmilk, grain hay, (check)
113	Guernsey	Female	5/4/15	65.5	
202	Holstein	Male	4/20/15	119.5	
422	Jersey	Female	5/2/15	53	
210	Holstein	Male	3/4/16	112	5—Silage, skimmilk grain, hay, (hay and grain limited.)
401a	Jersey	Male	5/7/16	78	
427	Jersey	Female	5/17/16	71	

In Table I is given the number, breed, sex, date of birth, and weight of the calves in Groups 1, 2, 3 and 5. The last column in the table shows the character of the ration fed. The experiment was started May 8, 1915 and as the calves varied in age at this time, they were divided as evenly as possible from this and other standpoints.

To Group I, it was intended to feed silage in a limited way, allowing it as early as it would be eaten, and in such amounts as would be readily consumed after the milk and grain were fed. A small amount was placed in the manger, soon after which hay was given. The grain ration was the same as was fed Group 3, the check group.

Group 2 was fed silage and skimmilk alone. While no hope was entertained that satisfactory calves could be raised in this way, it was desired to determine the maximum extent to which silage could supplement skimmilk, to find whether it could fulfill the requirements of a roughage, and to note its effect upon digestion when fed to the limit.

Group 3 is the check lot. They were fed skimmilk, grain and hay in the usual manner. The grain consisted of 2 parts cornmeal, 2 parts crushed oats, and 1 part wheat bran.

Group 5 was fed the same as Group 1, the difference being that an increased amount of silage was allowed. To encourage the consumption of more silage, the grain and hay were limited to a greater extent than in Group 1. This group was run after the first three experiments had been completed, the results of which were used as a basis in planning the feeding of Group 5. The grain ration was the same as that for Group 3 (as well as 1) with the exception that hominy was substituted for corn meal for the reason assigned in the discussion of the plan of the experiment.

The following tables show the amount of food consumed and the gains in live weight. It should be borne in mind that these data do not start from birth but from the time the calves entered on the experiment.

TABLE II.

POUNDS FEED CONSUMED BY GROUP 1.

	Fed to all 3 calves*			No. 401		No. 421		No. 205	
	Silage	Grain	Hay	Whole Milk	Skimmilk	Whole Milk	Skimmilk	Whole Milk	Skimmilk
1st. mo.	4.5	23.3	21.0	111.0	128.0	70.0	156.0	139.0	161.0
2nd mo.	42.0	66.0	49.0	—	327.0	—	307.0	—	391.5
3rd mo.	69.0	96.5	123.0	—	290.0	—	383.0	—	420.0
4th mo.	124.0	79.5	108.0	—	420.0	—	420.0	—	420.0
5th mo.	204.8	202.1	221.5	—	420.0	—	420.0	—	420.0
6th mo.	265.3	294.2	388.4	—	420.0	—	420.0	—	420.0
Total	709.6	761.6	910.9	111.0	2005.0	70.0	2106.0	139.0	2232.5
Total of Group	**709.6**	**761.6**	**910.9**	**320.0**	**6343.5**				
Av. of Group	**236.5**	**253.9**	**303.6**	**107.0**	**2114.5**				
Av. Daily Feed	**1.3**	**1.4**	**1.7**	**12.4**					

***Silage, grain and hay fed as a group.**

TABLE III.

POUNDS FEED CONSUMED BY GROUP 2.*

	Fed to both calves	No. 108		No. 103	
	Silage†	Whole Milk	Skimmilk	Whole Milk	Skimmilk
1st mo.	33.9	95.5	138.0	32.0	256.0
2nd mo.	115.0	—	289.0	—	378.5
3rd mo.	166.5	—	266.0	—	420.0
4th mo.	282.5	—	343.0	—	420.0
5th mo.	519.1	—	420.0	—	420.0
6th mo.	757.1	—	420.0	—	420.0
Total	1874.1	95.5	1876.0	32.0	2314.5
Total of Group	1874.1	127.5	4190.5		
Av. of Group	937.1	63.8	2095.3		
Av. Daily Feed	5.2	12.0			

*Data on No. 25 not included.
†Silage fed as a group.

TABLE IV.

POUNDS FEED CONSUMED BY GROUP 3.

	Fed to all 4 calves*			No. 105		No. 113		No. 202		No. 422	
	Silage	Grain	Hay	Whole Milk	Skimmilk	Whole Milk	Skimmilk	Whole Milk	Skimmilk	Whole Milk	Skimmilk
1st mo.	—	29.9	16.1	65.0	176.0	97.0	125.0	40.0	280.0	91.0	159.0
2nd mo.	—	67.5	28.0	—	291.0	—	218.0	—	403.0	—	266.0
3rd mo.	—	108.0	125.0	—	288.5	—	315.5	—	420.0	—	359.5
4th mo.	—	93.0	142.0	—	367.0	—	400.0	—	420.0	—	420.0
5th mo.	—	216.4	279.3	—	420.0	—	420.0	—	420.0	—	420.0
6th mo.	—	410.7	496.1	—	420.0	—	420.0	—	420.0	—	420.0
Total	—	925.5	1086.5	65.0	1962.5	97.0	1898.5	40.0	2363.0	91.0	2044.5
Total of Group	—	925.5	1086.5	293.0	8268.5						
Av. of Group	—	231.4	271.6	73.0	2067.1						
Av. Daily Feed	—	1.3	1.5	12.0							

*Grain and hay fed as a group; no silage fed.

TABLE V.

POUNDS FEED CONSUMED BY GROUP 5.

	Fed to all 3			No. 210		No. 401a		No. 427	
	Silage	Grain	Hay	Whole Milk	Skimmilk	Whole Milk	Skimmilk	Whole Milk	Skimmilk
1st mo.	1.5	9.5	2.0	214.0	165.0	180.5	76.0	142.0	81.5
2nd mo.	122.7	83.5	34.9	—	420.0	—	408.5	—	419.0
3rd mo.	264.0	82.5	37.5	—	420.0	—	420.0	—	420.0
4th mo.	409.3	74.1	43.3	—	406.0	—	420.0	—	420.0
5th mo.	546.6	93.5	62.5	—	420.0	—	420.0	—	420.0
6th mo.	706.5	127.4	91.5	—	420.0	—	420.0	—	420.0
Total	2050.6	470.5	271.7	214.0	2251.0	180.5	2164.5	142.0	2180.5
Total of Group	2050.6	470.5	271.7	536.5	6596.0				
Av. of Group	683.5	156.8	90.6	178.8	2199.0				
Av. Daily Feed	3.8	.87	.5	13.0					

TABLE VI.

GAINS IN WEIGHT—GROUPS 1 AND 2.

	Group 1				Group 2			
Calf No.	401	421	205	Av. of Group	108	25	103	Av. of Group*
Birth wt.	61	60	111	77	68	72	68	68
Initial wt.	61	60	111	77	68	85	86	77
1st 4 weeks	21	18	27	22	10	5	14	12
2nd 4 weeks	26	24	46	32	7	—4	33	20
3rd 4 weeks	9	24	27	20	6	9	23	15
4th 4 weeks	26	22	19	25	3	5	19	11
5th 4 weeks	37	32	58	42	28	dead	32	30
6th 4 weeks	71	53	95	73	36	—	41	39
Last 2 weeks	29	19	30	26	7	—	17	12
Final wt.	280	252	413	315	165	100	265	215
Total gain	219	192	302	240	97	15	179	138
Daily gain	1.2	1.1	1.7	1.33	.5		1.	.77

*Data on No. 25 not included.

TABLE VII.

GAINS IN WEIGHT—GROUPS 3 AND 5.

	Group 3					Group 5			
Calf No.	105	113	202	422	Av. of Group	401a	427	210	Av. of Group
Birth wt.	70	65	114	57	77	65	58	100	74
Initial wt.	61.5	65.5	119.5	53	75	78	71	112	87
1st 4 weeks	24	18	33	19.5	23.6	33	32	27	31
2nd 4 weeks	18.5	16.5	47.5	23.5	26.5	37	29	37	34
3rd 4 weeks	12	14	22	16	16	28	28	44	33
4th 4 weeks	22	15	38	21	24	28	34	47	36
5th 4 weeks	38	38	65	38	45	39	29	41	36
6th 4 weeks	64	56	64	44	57	50	39	37	42
Last 2 weeks	28	25	47	30	32.5	25*	25*	26	26
Final wt.	268	248	436	245	299	318	287	371	325
Total gain	206.5	182.5	316.5	192	224.4	240	216	259	238
Daily gain	1.1	1.0	1.7	1.1	1.25	1.3	1.2	1.4	1.32

*Estimate—the last two records of these calves were not taken.

In tables II-III-IV and V are given the amounts of whole milk, skimmilk, grain, silage and hay consumed during the trial, together with totals and averages for each group. The last item in each table shows the average daily consumption of feed for each calf. Tables VI and VII give the gains by four week periods, together with the final weight, total gain and average daily gain for each calf.

OBSERVATIONS AND COMMENTS.

Group 1—The ages of the calves in Group 1 at the beginning were 7, 13 and 6 days. Whole milk was fed to 14 days of age at which time skimmilk was introduced. They were completely on skimmilk at 20 days of age. On the second day after the beginning of the experiment, No. 401, the youngest calf in this group, developed scours. He was somewhat hide bound but remained bright and showed improvement. Again on the 20th day, he showed indications of scours but quickly recovered. From this time on, he grew well, especially in height. · Calf No. 205 was very thrifty and at the end of the trial was considered, with the possible exception of No. 401, as the best conditioned calf of any in Groups 1, 2, or 3. Calf 421 showed indications of scours at the beginning. On the 8th day she was still weak but showing improvement; on the 20th day she was still hidebound and "mussy" at the buttocks, but by the 30th day was in good condition and remained thrifty from this time on. During the experiment, this group consumed an average of 107 pounds of whole milk, 2114.5 pounds of skimmilk, 236.5 pounds of silage, 253.9 pounds of grain, and 303.6 pounds of hay. The average daily consumption was 12.4 pounds of milk, 1.3 pounds of silage, 1.4 pounds of grain, and 1.7 pounds of hay from which they made an average gain of 1.33 pounds. No. 401 gained 1.2 pounds, No. 421, 1.1 pounds, and No. 205, 1.7 pounds daily.

Group 2—The age of the calves of this group at the beginning was 27, 30 and 6 days. The two older calves were placed in this group because it was not thought advisable to start at 14 days of age upon skimmilk and silage alone. Nos. 25 and 103 had, previous to the beginning of the experiment, eaten some grain. Five days were taken for the change to skimmilk with the two older calves, thus they were 33, 37 and 20 days respectively of age when on skimmilk wholly. From the beginning No. 25 was listless and soon developed scours from which he never completely recovered. He showed a craving for food at first and until isolated lapped urine from his mates. On the 12th day he appeared brighter but soon lapsed into a dull, listless condition again. On the 12th day he ate some silage and on the 14th day he had bloody scours. He was treated and given 1 pound of whole milk with a little hay and grain for a few days. On the 22nd day silage was again given which produced scours. He was carried along for 129 days during which time he was occasionally given silage and when he would take it, scours invariably developed. By this time, he showed a decided lack of nutrition and would not have lived so long had he not occasionally been given feed other than skimmilk and silage. He was finally put to death and it was found that the digestive tract was very much inflamed in places and the inner lining much distorted. No. 103 was scouring slightly at the beginning, but soon recovered. On the 10th day he ate silage eagerly and on the 12th was scouring, but by the 17th day of the experiment was making satisfactory progress. From this time on he made quite regular gains, increasing in height but not much in width. When walking, however, his feet and legs shuffled in a manner indicating low vitality. No. 108 was somewhat indisposed at first and developed scours slightly in 7 days. At the end of 20 days, he showed more life and better condition. At times, he refused silage and showed little appetite and at 35 days in the experiment developed a bad case of scours. He would spend considerable time gnawing wood from his pen. He became somewhat better and would eat well occasionally, but at 60 days and again at 96 days developed scours. He completed the experiment with little gain in weight, low vitality, shaggy coat and with all the indication of subnormal nutrition. The records of Nos. 108 and 103 are alone included in computing the results. The average whole milk consumed was 63.8 pounds, skimmilk 2095.3 pounds and silage 937.1 pounds. The average daily consumption was 12 pounds of milk and 5.2 pounds of silage from which they made an average gain of 0.77 pound. No. 108 gained 0.5 of a pound and No. 103, 1.0 pound daily. Both calves were apparently devoid of fat and the skin was very thin, altho with No. 103 it was fairly loose.

Group 3—The age of the calves in this group at the beginning was 7, 4, 18 and 6 days. With the exception of the older one, they were changed to skimmilk at 2 weeks of age, being completely on this ration at 20 days. No. 202, the oldest, went on at a little greater age than the others. No. 105 was scouring somewhat at the start but was better in three days. On the 7th day he was still loose, somewhat weak, and with poor appetite, but improving slightly. Twenty-three days from the start of the experiment his bowels were again somewhat loose. From this time up to the 85th day he had occasional periods of scouring but for the remainder of the trial was thrifty, and while thin, finished in fairly good condition. No. 113 showed looseness of the bowels on the 7th day and again on the 12th. She went thru a period during which gains were only moderate and developed scours on the 56th day. After this period, she showed improvement and good growth. No. 202 was slightly loose at first but soon became normal and, with the exception of one four week period, made good gains thruout. During the latter part of the trial, he appeared to lack vigor and snap, and some few weeks after showed lameness which developed into severe locomotor ataxia which doubtless accounted for the condition referred to. No. 422 showed looseness for several days but marked indications of scouring did not appear until the 24th day. About the 50th day, he again developed scours, but a week later had recovered and while in a thin condition made good gains from this time on. During the experiment, this group consumed an average of 73 pounds of whole milk, 2067.1 pounds of skimmilk, 231.4 pounds of grain, and 271.6 pounds of hay. This is a daily average of 12 pounds of milk, 1.3 pounds of grain and 1.5 pounds of hay from which No. 105 made a daily gain of 1.1 pounds, No. 113, 1.0 pound, No. 202, 1.7 pounds, and No. 422, 1.1 pounds. This gives an average gain for the group of 1.25 pounds.

GENERAL DISCUSSION OF GROUPS 1, 2 AND 3.

It is seen that considerable difficulty was encountered with indigestion with the three groups described. A number of calves came at one time and quarters were crowded, thus some of them went into the experiment under adverse conditions. A persistent infection invaded them and considerable time was required to get them all going well, during which period oil was given freely. On the 46th day, bran was removed from the ration for two weeks to eliminate its laxative qualities.

About the 100th day of the experiment the feeder, not having a good choice of hay at this time (mid-summer), weighed a supply that was dry and wiry, causing constipation in several calves; linseed oil was given freely. At this time one calf in Group 4 (diluted milk group) was lost.

On account of the difficulties encountered with these groups at the beginning, the remainder of the groups were not changed from whole milk so rapidly nor offered silage so early. While a little silage is eaten as early as two weeks of age, it is negligible so far as nutritive value is concerned and there is no doubt but that a satisfactory start is a tremendous factor in feeding any ration to calves. In this case however, the silage cannot be looked upon as the sole cause of the difficulty since Group 3, the check lot, was affected even more than Group 1 which received silage. The fact that these calves were in adjacent pens caused the diarrhea to persist.

Of these three groups (Nos. 1, 2, and 3), No. 1 was superior throughout although No. 3 improved well at the last.

Group 2, of course, was a failure from the standpoint of development on account of the loss of No. 25, poor gains of No. 108 and incomplete development of No. 103.

Group 5—As has been previously stated, this group was run somewhat later than the ones just discussed. After the completion of the first four groups, later ones were formed and started as calves became available. Group 5 was fed the same as Group 1 except that more silage was given; also whole milk was fed longer. These calves were wholly upon skimmilk at 36 days on an average, starting the change at an average age of 25 days. No. 210 began eating silage at 34 days of age. He was a vigorous, growthy calf at all times and always showed a marked appetite for silage. Often when grain and silage were placed before him after receiving the milk, he would indicate a preference for silage by eating it first; in fact he consumed so much that he became somewhat "pot bellied." No. 401a was scouring at 11 days but soon recovered and made good gains throughout although on account of new hay being fed developed colic on the 63rd day. At 40 days he began eating silage. No. 427 also was vigorous and growthy thruout the trial. She began eating silage at 28 days. All of these calves were more thrifty and showed better shaped bodies than those of either Groups 1, 2 or 3. They consumed on an average 178.8 pounds whole milk, 2199.0 pounds skimmilk, 683.5 pounds silage, 158.8 pounds grain and 90.6 pounds hay. The average daily consumption was 13 pounds milk, 3.8 pounds silage, 0.87 pound grain and 0.5 pound hay from which No. 401a gained 1.3 pounds, No. 427, 1.2 pounds, and No. 210, 1.4 pounds. The average daily gain was 1.32 pounds.

RESULTS AND SUMMARY OF GROUPS 1, 2, 3 AND 5.

As pointed out, these groups, except the control (Group 3), are silage fed groups. In Group 1, the object was to find how successfully silage could be fed and at how early an age; Group 2 was fed to find if silage could entirely replace the grain and hay; and Group 5 to find how much grain and hay could be saved by increasing the silage fed over that given to Group 1. Table VIII summarizes the silage feeding.

TABLE VIII.

SUMMARY OF SILAGE FEEDING TO GROUPS 1, 2, 3 AND 5.

Group	Age first Fed	No. Days Fed Maximum Amt.	Maximum Amt. Fed in day lbs.	Total Av. Amt. Fed lbs.	Av. Amt. Fed Daily lbs.	Av. Daily Gain lbs.
1	10 days*	1	4	236.5	1.3	1.33
2	10 days**	1	10.5	937.1	5.2	0.77
3	Check—	No Silage	—	—	—	1.25
5	31 days—	several	9	683.5	3.8	1.32

*To two calves. Other slightly older.

**To one calf. Other two above 30 days old.

Most of the calves would start eating silage about as early as they would begin on hay. At first they were given more than they would pick up and the refuse was weighed and recorded. Some loss due to evaporation of moisture of course took place while in the manger but at this stage the amount was insignificant. In most cases, they soon ate silage readily; a few required some time to accustom themselves to it. Some calves showed a marked fondness for it and at three or four months of age all relished it—eating greedily of it and seldom leaving any of the amount given.

TABLE IX.

AVERAGE CONSUMPTION OF SILAGE PER CALF—GROUPS 1, 2 AND 5

Period	GROUP 1		GROUP 2		GROUP 5	
	Total lbs.	Limit per day lbs.	Total lbs.	Limit per day lbs.	Total lbs.	Limit per day lbs.
10 to 30 days	1.5	0 to .3	17.0	0 to 1.3	.0	0
2nd mo.	14.0	.2 to .7	57.5	1.3 to 2.8	40.9	1.0 to 2.2
3rd mo.	23.0	.7 to 1.0	83.3	2.8 to 3.5	88.0	2.0 to 3.7
4th mo.	41.0	1.0 to 1.7	141.3	3.5 to 6.0	133.1	3.0 to 5.7
5th mo.	68.3	1.5 to 3.5	259.5	6.5 to 9.6	182.2	5.0 to 7.0
6th mo.	88.4	2.7 to 4.0	378.5	9.6to14.1	235.5	7.0 to 9.0

Table IX shows the amount of silage eaten during successive months by the groups under discussion. The figures under "Limits per day" show the minimum and maximum day's consumption on a one calf basis for various months. In other words, the minimum figure represents approximately the amount started with at the beginning of the month, while the maximum represents the amount being fed at the end of the month's period. For this reason, the maximum of any particular month is approximately the same as the minimum for the succeeding month. The rate of increase for Group 1 per month, therefore, did not exceed 2 pounds at the greatest; for Group 2 the maximum increase in one month was 4.5 pounds in the sixth month; for Groups 5 from 2 to 3 pounds per month during the last three months. Group 2, on account of not receiving grain and hay, ate more of the silage.

It was observed that Holstein calves had a greater appetite for silage than the others and this should be considered in feeding silage. In Group 5, the Holstein calf No. 210 would eat considerably more at a given age than either of the two Jerseys, the difference being as much as 2 pounds daily.

In the experiments, the increases were generally made by half pounds, allowing several days between each increase. During the first three months when the digestive system is only developing and is fitted for handling only the more easily digested foods the results will be better if the increases are made very gradually. If scours develop for any reason, silage should be fed cautiously, because of its laxative nature and fibrous character. And with the young calves, it is better not to feed grain on the silage, thus permitting them to eat silage only of their own free will.

A gain of 1.25 pounds per calf per day is evidence of good growth; thus the gains produced in Groups 1 and 5, together with the general good health of the calves at the end of 180 days indicate that silage, grain, and hay are as good supplements to skimmilk as grain and hay alone.

An analysis was not made of all the feeds given but using the average of digestion trials reported by Henry and Morrison [9] Table X was compiled.

TABLE X

Digestible Nutrients Consumed per Calf by Groups 1, 2, 3 and 5.

Group	Total Nutrients-lbs.	Nutrients per day-lbs.	Nutrients per lb. gain	Nutritive ratio-1 to	Dry Matter per lb. gain
1.	584.7	3.25	2.43	3.90	3.26
2.	367.9	2.04	2.66	3.19	3.35
3.	487.3	2.70	2.17	3.54	2.96
5.	512.2	2.84	2.23	3.86	2.80

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[9] Henry, W. A. and Morrison, F. B., "Feeds and Feeding," 15th Edition (1915).

It is clearly seen in Table X that the ration of Group 2 (silage and skimmilk alone) was strikingly different from the others both in the amount of nutrients and the nutritive effects. It was low in total nutrients and more were required per pound of gain than in the other groups. Whether more liberal feeding of skimmilk would make it successful is unknown, but this is not probable. As pointed out, No. 25 was eventually killed because it was doing so poorly, and the others failed to grow satisfactorily. Since more dry matter and digestible nutrients per pound of gain were eaten and less total nutrients given than to the other groups, the lack of development may have been due to either or both of two things: (1) disturbance in the digestive tract due to improper physical composition of the ration which did not allow enough feed to be digested; (2) insufficient quantity of food nutrients in the ration given. As already pointed out, one of the two calves which completed the experiment was continually scouring and the other was very much troubled in this respect, indicating that the digestive tract was not functioning normally.

It is seen from Table X, that Group I (limited silage), skimmilk, grain, and hay has eaten more than either Group 3 or 5. Referring to Table VI, it is seen that this group also made the greatest gain, though only slightly better than Group 5. The silage seems to have increased the capacity, or the desire of this group for food; besides eating the silage, 22.5 pounds more grain and 32 pounds more hay was consumed per calf than by Group 3 which had no silage.

Groups 3 and 5 do not differ much in results. Group 3 required slightly less nutrients per pound of gain but Group 5, with the wider nutritive ratio (approaching 1 to 4) made the better daily gains. Group 5 ate 74.6 pounds less grain and 181.0 pounds less hay per calf than Group 3, the balance being supplied by the nutrients in the silage. In other words, the silage took the place of 32 per cent of the grain and 66 per cent of the hay.

COSTS OF FEED FOR GROUPS 1, 2, 3 AND 5.

The cost is the final basis of comparison from the standpoint of the farmer. In the earlier tables and studies of these data,* costs based upon prices paid in this section in 1915-16 were adopted. Later, the costs based on prices in December 1917 were calculated. The following table gives the prices of all the feeds used.

TABLE XI—FEED PRICES.

FEED	PRICE PER HUNDRED. 1915-16	 Dec. 1917.
Whole Milk	$2.32†	$3.72‡
Skimmilk	.40	1.00
Silage	.25	.30
Hay	.80	.90
Ground Oats	1.90	2.50
Bran	1.30	2.50
Hominy	1.60	3.35
Corn Meal	1.70	4.00
Blood Meal	3.75	7.00
Red Dog Flour	1.55	3.25
Schumacher Calf Meal	3.75	4.50
Middlings	1.40	2.50
Linseed Oil Meal (OP)	1.75	3.25

† Based on 5 cents per qt.
‡ Based on 8 cents per qt.

The price of skimmilk, even at 40 cents per cwt., in 1915-16, is higher than is reported in other feeding trials. It is often not considered so valuable on the farm, yet it could not usually be bought for this price even in 1916. Table XII is based upon the 1915-16 prices and also upon the prices of feeds the middle of December, 1917.

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* Thesis prepared by J. A. Kuelling.

TABLE XII.

Feed Cost, Cost per Day and Cost per Pound Gain Groups 1, 2, 3 and 5.

Group	Av. Daily Gain—lbs.	1915-1916 Prices			December 1917 Prices		
		Cost per Calf	Cost per Calf per Day	Cost per Lb. Gain	Cost per Calf	Cost per Calf per Day	Cost per Lb. Gain
1	1.33	$18.28	$ .102	$ .076	$36.43	$ .203	$ .152
2	0.77	12.21	.068	.089	26.14	.145	.189
3	1.25	16.09	.089	.071	33.02	.184	.147
5	1.32	18.05	.100	.079	35.96	.200	.157

Table XII shows that the presence of silage in the ration at $5.00 per ton at the 1915-16 prices, and $6.00 at the December 1917 prices, did not seem to cheapen the cost per pound of gain. As a matter of fact, the cost for Group 3 (no silage) is somewhat less than either Group 1 or 5, which are essentially the same. The highest cost per pound gain, excluding Group 2, is with Group 5 which received the greatest amount of silage. But Group 5 received the greatest amount of whole milk also, and the higher cost is a result of feeding more whole milk. If no more whole milk had been fed them than was given Group 3, the costs would have been lower for Group 5, assuming that they would have made gains equal to Group 3 by consuming less whole milk. This discrepancy in the cost of gains can be shown by considering the detailed cost of each feed which follows: Group 3—grain $7.17, hay $2.45, skimmilk $20.67, whole milk $2.73; Group 5—grain $4.45, hay $ .82, silage $2.05, skimmilk $21.99, whole milk $6.65. The total roughage cost for Group 3 was $9.62 while for Group 5 it was only $7.32, a difference of $2.30 in favor of Group 5. The difference in cost of whole milk was $3.92 in favor of Group 3 and the skimmilk was $1.32 in favor of the same group. This justifies the conclusion that the presence of silage actually affected a saving in the cost when fed in considerable quantities. It would also seem that the calves in Group 1 were stimulated by a limited amount of silage to larger gains thru the increased consumption of grain and hay.

TABLE XIII

COMPOSITION OF CORN SILAGE.

Date of Sample.			Water	Dry Matter	Ash	Protein	Ether Ext.	Fiber	N—Free Ext.
			%	%	%	%	%	%	%
Feb.	9,	'15	78.88	21.12	1.16	2.00	0.56	6.04	11.36
May	1,	'15	77.71	22.29	1.13	1.97	0.63	6.67	11.89
Nov.	25,	'15	78.90	20.10	1.05	1.48	0.44	5.99	11.14
Dec.	29,	'15	73.48	26.52	1.31	2.05	0.60	6.95	15.61
Jan.	18,	'16	75.75	24.25	1.20	2.06	0.57	6.86	13.57
Feb.	22,	'16	76.05	23.95	1.39	1.79	0.61	6.65	13.51
Apr.	17,	'16	74.30	25.70	1.35	2.19	0.66	7.38	14.12
June	15,	'16	84.11	15.89	0.69	1.04	0.51	5.58	7.96
Dec.	6,	'16	84.28	15.72*	——	——	——	——	——
Jan.	26,	'17	79.47	20.53*	——	——	——	——	——
May	16,	'17	78.07	21.93*	——	——	——	——	——

* Samples lost by fire before analysis was completed.

Table XIII gives the chemical analysis of eleven composite samples covering ten days each. Samples taken each day were placed in fruit jars tightly sealed and taken to the chemical laboratory where moisture determinations were made at once. As the silos were filled in September of each year, this month will serve to classify the silage into three years of crop production, viz., 1914, 1915, and 1916.

The corn from which this silage was made consisted mostly of the variety Eureka, a rank growing corn that does not usually mature in this locality. Some Leaming, which becomes more nearly mature, was also used for this purpose. It is seen from this table that the silage contains a large percentage of moisture and a correspondingly low percentage of dry matter, a condition, fairly representative of the State.

SCHUMACHER CALF MEAL AND SILAGE.

Group 6 was fed very much the same as Group 5, except that calf meal was given in place of skimmilk. The calves in this group, with facts concerning them, are given in Table XIV.

TABLE XIV

MAKE-UP GROUP 6—SCHUMACHER CALF MEAL.

No. Calf	Breed	Sex	Date of Birth	Wegiht Lbs. Initial	Group Ration
214	Gr. Holstein	Male	2/11/16	89	Schumacher calf meal, grain, hay and silage (hay and grain limited)
224	Holstein	Female	3/9/16	100	
108a	Guernsey	Male	6/15/16	94	
426	Jersey	Female	5/13/16	75	

The calf meal was prepared according to the directions found in the bag. No. 108a was started on the meal at 16 days of age and the milk was entirely removed at 55 days. No. 214 began getting meal at 27 days and was completely off milk at 64 days. No. 224 began the meal at 24 days and was on meal alone at 37 days. No. 426 began to get meal at 20 days but was never completely on the meal and was removed from the experiment at 75 days of age. The average age at which meal was begun was 22 days and at 58 days of age they were completely off milk and receiving calf meal in gruel form together with grain, hay and silage, (excluding No. 426). The grain was the mixture fed to Group 5, viz., 2 parts hominy, 2 parts crushed oats, and 1 part bran.

As a group, this one cannot be looked upon as having given entirely satisfactory results. Nos. 426 (Jersey) and 108a (Guernsey) particularly, found the ration unpalatable and unsatisfactory and did not make consistent gains. No. 426 never ate the gruel unless it also contained some milk and even then she often refused it. At times she would not eat silage and was never increased as rapidly as scheduled for this feed. She was finally removed from the experiment after 75 days in order that she might have a chance to develop normally. She was very thin and weak and the hair was rough, giving every evidence of improper or insufficient nutrition.. No. 108a did little better. He would not take the gruel readily without milk, and would not take the increase of meal as rapidly as called for in the directions, nor did he consume silage in very large quantities. After the 75th day, he ate somewhat better but never developed a liking for silage. He appeared hungry, was thin and weak and the feces had a very offensive odor altho for the most part he continued to grow. At the end, he was fairly vigorous and growthy but thin and his hair was very rough and long. No. 214 was off feed a number of times and did not eat silage to any extent until over two months of age. He was low in vitality and shallow of body thruout the experiment and had long hair. No. 224 did not handle the meal as rapidly as scheduled in the directions for feeding and did not develop an appetite for silage until more than two months of age. At first she was thin, weak and shallow, "mussy" behind and the coat was rough. She improved gradually after two months, altho she never filled out well and her coat remained rough. All in this group scoured quite freely especially during the first three months. The calves in this group, except Nos. 214 and 224 during the last two months were fed individually. These two calves were fed grain, hay and silage together during the period mentioned. The monthly feed consumed is given in Table XV.

TABLE XV.

POUNDS FEED CONSUMED BY GROUP 6.

No. 108a—Born June 15, '16—On Experiment July 1, '16.

	Whole milk	Skim milk	Schumacher meal	Grain	Hay	Silage.	Remarks.
1st mo.	118.4	——	44.7	15.0	16.0	——	
2nd mo.	17.1	——	50.0	12.5	10.0	10.1	
3rd mo.	——	——	50.8	20.4	17.5	30.0	On 5 months only.
4th mo.	——	——	52.5	22.2	28.7	96.1	
5th mo.	——	——	52.5	44.6	32.1	151.0	
6th mo.	——	——	——	——	——	——	
Total	135.5	——	250.5	114.7	104.3	287.2	

No. 426—Born May 13, '16—On Experiment May 15, '16.

1st mo.	201.0	—	19.0	—	—	—	
2nd mo.	165.0	—	34.1	17.0	8.4	2.7	
3rd mo.	84.8	—	21.5	7.5	6.0	6.7	On 75 days only.
4th mo.	—	—	—	—	—	—	
5th mo.	—	—	—	—	—	—	
6th mo.	—	—	—	—	—	—	
Total	450.8	—	74.6	24.5	14.4	9.4	

No. 214—Born Feb. 11, '16—On experiment Feb. 13, '16.

1st mo.	244.5	—	—	6.5	—	—
2nd mo.	—	163.0	40.8	22.3	8.0	2.3
3rd mo.	—	—	58.0	44.0	24.3	40.1
4th mo.	—	—	45.0	37.3	17.5	75.9
5th mo.	—	—	53.1	32.0	13.0	111.4
6th mo.	—	—	60.0	24.0	20.0	175.3
Total	244.5	163.0	256.9	166.1	82.8	405.0

No. 224—Born March 9, '16—On experiment March 13, '16.

1st mo.	221.0	—	16.3	5.0	—	0.4
2nd mo	—	—	52.9	24.8	19.8	9.9
3rd mo.	—	—	50.0	29.5	16.5	73.3
4th mo.	—	—	52.3	58.6	20.0	113.7
5th mo.	—	—	60.0	32.0	13.0	177.7
6th mo.	—	—	60.0	24.1	20.0	219.0
Total	221.0	—	291.5	174.0	89.3	594.0
Av. of 214 and 224	232.8	81.5	274.2	170.1	86.1	499.5
Av. daily ration	—	—	1.5	0.9	0.5	2.8

As previously explained, Nos. 108a and 426 did not complete the experiment. The daily average food consumed is therefore computed for Nos. 214 and 224 (Holsteins) only. The average daily feed is tabulated for comparison with that consumed by Group 3, the check lot (no silage), and Group 5, a skimmilk lot on silage, limited grain and hay.

TABLE XVI

FOOD EATEN DAILY—GROUPS 3, 5, AND 6.

Group	Milk	Grain	Hay	Silage
3	12.0	1.3	1.5	—
5	13.0	0.87	0.5	3.8
6 (2 calves)	1.5*	0.9	0.5	2.8

*Dry calf meal.

The milk consumed by Group 5 shown in Table XV contains slightly less dry matter than is contained in the calf meal. The daily grain consumption is approximately the same, tho slightly greater for the calf meal group, the hay is exactly the same and Group 5 has eaten daily one pound more of corn silage. It was observed, and is borne out in the detailed report of the feed eaten, that the calves in Group 6 did not begin to relish silage so early as those in the other groups.

TABLE XVII

GAINS IN WEIGHT—GROUP 6.

Calf No.	108a	214	224	426	Total*	Av.*
Birth Wt.	78	89	97	75	186	93
Initial Wt.	94	89	100	75	189	95
1st 4 weeks	25	36	9	9	45	23
2nd " "	20	26	19	22	45	23
3rd " "	16	24	16	6	40	20
4th " "	17	21	19	—	40	20
5th " "	45	21	18	—	39	19
6th " "	16	30	32	—	62	31
Last 2 "	—	6	18	—	24	12
Final Wt.	233	253	231	112	484	242
Total Gain	139	164	131	37	295	148
Daily Gain	.93	.91	.73	.5	—	.82

*Includes only 214 and 224.

It is seen in Table XVII that while Nos. 108a and 426 are given, their weights are not taken into consideration in the average. No. 426 was off feed so much that it was necessary to feed a considerable amount of whole milk as a consequence. Being started on calf meal at an early age (20 days), may account for the difficulty encountered here. No. 108a made slightly better gains than the others but as he was on the ration only five months the results are not included in the final average; to offset this, is the record of No. 426 that was discontinued after seventy-five days and in which the gains in the corresponding period were not equal to any of the others. The average gain per day for No. 108a is 0.93 pound; for No. 214, 0.91 pound; for No. 224, 0.73 pound; for No. 426, 0.5 pound, and the average for Nos, 214 and 224 (Holsteins) for the entire period is 0.82 pound per day.

Lindsey [9] secured an average gain slightly better than a pound a day with Schumacher calf meal but fed from 1200 to 1500 pounds of skimmilk per calf.

TABLE XVIII

COST OF FEED PER CALF FOR GROUP 6.
(Nos. 214 and 224 only)

Feed	Amount lbs.	Cost per Calf 1915-'16	Dec. 1917	Cost per lb. Gain 1915-'16	1917
Whole Milk	232.7	$ 5.40	$ 8.66		
Skimmilk	81.5	.33	.82		
Schumacher	274.2	10.28	12.34		
Grain	170.0	2.89	4.88		
Silage	499.5	1.25	1.50		
Hay	86.0	.69	.77		
Total		20.84	28.92	$ .141	$ .196

The feed costs in Table XVIII are based upon the prices shown in Table XI. The total cost on the December, 1917 basis is $28.92. Compared to Group 1 which was $36.43 and Group 5 which was $35.96, (all three silage fed groups) the cost was less. But the cost per pound gain is $.193, $.152 and $.157 respectively. Although the total cost for six months feeding on the Schumacher Calf Meal was six to seven dollars less, the cost for each pound of gain was 4 cents more. While Group 6 was gaining a total of 148 lbs. per calf, those in Group 1 gained 240 pounds and those in Group 5 gained 238 pounds. Many dairymen make this serious error of sacrificing development and even economy of gain for a somewhat lower total cost of feed during the first six months of the calf's existence, and there is little doubt but that this under development is in many instances reflected in the milk yield obtained later in life. These calves are merely following a simple law of nature, which has been shown over and over in feeding trials of young animals; during this plastic stage, advantage should be taken of growth promoting rations if the cheapest gains are to be secured. Comparing this group with those receiving milk, it is seen that the cost per pound gain is higher and the total gain is less. Even skimmilk possesses properties of growth far in excess of foods derived from the grains.

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[9] Lindsey, J. B. "Substitutes for Milk in the Raising of Dairy Calves," Mass. Agr. Exp. Sta., Bul. No. 164, 1915.

So far as the feeding of silage with the calf meal is concerned, it must be concluded that it is of doubtful value in the ration at least under three months. The difficulties of securing sufficient nutrients for growth from the calf meal are such that the digestion is probably disturbed or hindered by the presence of silage, especially during the first three months of the calf's life. This ration has an average nutritive ratio of approximately 1 to 6. During the first six months, such a ration must be regarded as being deficient in protein and of course is not improved in this respect by the presence of silage.

RESULTS WITH DILUTED MILK RATIONS.

Groups 4, 7, 8, 9 and 10 were fed diluted milk rations. The plan was to give milk thruout the first six months of the calf's life, not alone for its nutritive value, but also because of the now well known existence of growth essentials contained therein. Milk not only promotes growth but it promotes health and vitality as well. The amount of milk thus fed was about the same as is fed on many farms up to three months of age at which time calves are often placed wholly upon milk substitutes, usually in the form of calf meals mixed with water or upon dry feeds alone.

The milk was diluted in order that it might be more completely consumed from the pails, as well as to better satisfy the calf by filling its stomach. The total amount fed daily after dilution was 14 pounds, which is the amount of skimmilk fed to the calves in our dairy. Since the majority of calf feeding experiments are with skimmilk and as skimmilk is successfully used for this purpose on many farms, the results sought in this phase of the investigation was to produce calves equal to skimmilk calves. In studying the results of the preceding and succeeding pages, attention should be given the fact that under our conditions less skimmilk has been fed than is generally given in other experiments or in localities where it is abundant.

Group 4 was the first group to be raised on diluted milk. It was run simultaneously with Groups 1, 2 and 3. Group 4 was given a 46% dilution milk ration, i.e., 46% of the 14 pounds fed daily consisted of fresh whole milk, and 54% of water. Jersey milk was used for this purpose and it was so calculated that the energy value *thus contained was equivalent to an equal quantity (14 lbs.) of skimmilk. Since excellent results were secured with these calves, but at a rather high cost, the milk was diluted more for later groups, 25% of the 14 pounds allowed being whole milk. Such an amount (3½ lbs.) was fed daily to Groups 7, 8, 9 and 10.

The results with Group 7 are not presented as the milk was reduced early and some of the feeds planned for did not arrive in due time which resulted in a poor start. Also as a contributing factor, the feeder, because the prescribed grain was not available, carried them along for several days upon diluted milk without a grain supplement, and while they continued on experiment for 100 days after the arrival of the ingredients their condition was so unsatisfactory that they were removed from the experiment and given a different ration. Group 8 was run along the original plans for Group 7.

The fat content of some composite samples from the diluted milk is given in the following table; the Babcock Test was used to get the results.

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*The energy value of 1 gram of milk protein is 5.86 calories.
The energy value of 1 pound of milk protein is 2658.04 calories.
The energy value of protein in 1 lb. of skimmilk is 94.89 calories.
The energy value of 1 gram of milk sugar is 3.95 calories.
The energy value of 1 pound of milk sugar is 1791.68 calories.
The energy value of sugar in 1 lb. of skimmilk is 88.69 calories.
The energy value of 1 gram of milk fat is 9.23 calories.
The energy value of 1 pound of milk fat is 4186.64 calories.
The energy value of fat in 1 lb. of skimmilk is 4.19 calories.
Total energy value of 1 lb. average skimmilk is 187.87 calories.
The energy value of 1 pound of average Jersey milk is

Fat	215.19	calories.
Protein	101.01	"
Sugar	90.30	"
	406.50	"

To equal skimmilk in energy value, each pound of Jersey whole milk should be diluted with 1.16 pounds of water giving a ratio of 46% milk and 54% water.

Values secured from Hammerstein, "Physiological Chemistry," page 829, and Richmond, "Dairy Chemistry," page 406 for fuel values; Bureau of Animal Industry Bulletin No. 156 for composition of Jersey milk, Eckles, C. H. and Shaw, R. H., "The Influence of Breed and Individuality on the Composition and Properties of Milk."

TABLE XIX.

FAT CONTENT OF DILUTED MILK AND SKIMMILK SAMPLES.

Sample No.	1916		1915	
	25% Dilution	Skimmilk	46% Dilution	Skimmilk
	Percent	Percent	Percent	Percent
1	1.4	0.11	2.55	0.30
2	1.1	0.04	2.4	0.27
3	1.55	0.20	2.4	0.28
4	1.1	0.04	2.4	0.23
5	1.25	——	2.2	0.20
6	1.1	——	2.35	0.21
7	.6	——	2.35	0.15
8	1.6	——	2.30	0.04
9	——	——	2.35	0.05
10	——	——	2.20	0.13

The figures in Table XIX show the fat content of some diluted milk and skimmilk samples during 1915 and 1916. The samples diluted to 25% Jersey milk and 75% water ranged usually between 1 and 1.5% fat and the total solid content of such milk should be in the neighborhood of 3.5 to 5%. The 46% diluted milk fed to Group 4 in 1915 tested very uniformly, ranging from 2.2 to 2.5%.

TABLE XX.

MAKE-UP OF DILUTED MILK GROUPS.

Calf No.	Breed	Sex	Date of Birth	Initial Wt. lbs.	Group and Ration
107	Guernsey	Male	5/2 /15	76	4—Diluted milk (46%) grain, and hay.
221	Holstein	Female	4/29/15	100	
420	Jersey	Female	4/15/15	51	
226	Holstein	Female	9/22/16	83	8—Diluted milk (25%), grain and hay.
13	Ayrshire	Female	9/25/16	74	
429	Jersey	Female	8/14/16	56	
228	Holstein	Female	10/13/16	98	9—Diluted milk (25%), with grain stirred in, dry grain and hay.
610	Shorthorn	Female	11/6 /16	68	
430*	Jersey	Female	11/23/16	54	
230	Holstein	Female	1/26/17	94	10—Diluted milk (25%), grain, hay and silage.
611	Shorthorn	Female	1/9 /17	72	
612	Shorthorn	Female	1/28/17	84	

* Died of pneumonia before actually starting on experiment.

Table XX shows the make-up of Groups 4, 8, 9 and 10. As already explained, Group 4 received 14 pounds of diluted milk of which 46% consisted of Jersey milk and the remainder of water. This group received the same grain mixture as did Groups 1, 2 and 3, i. e., 2 parts corn meal, 2 parts ground oats and 1 part wheat bran.

Group 8 was placed on a 25% diluted milk ration supplemented with grain consisting of 1 part blood meal, 1 part red dog flour, 3 parts ground oats and 3 parts hominy. In feeding a milk ration of only 3.5 pounds daily, it was assumed that there would not be a sufficient supply of protein in an ordinary supplementary grain ration for skimmilk. Blood meal supplies a large percentage of animal protein, and ash as well, and for this reason it was made a part of the grain ration. The ration was computed so as to give the nutrients as nearly as possible in the amounts needed for growing calves under six months of age. Swift and Company, from whom the blood meal was purchased, guaranteed it to contain not less than 80% protein nor more than 3% fiber. According to Henry and Morrison [10], a good grade of blood meal should contain about 82% protein, 3.3% ash, 3.8% nitrogen-free-extract, 0.9% fat and 9.7% water. While Group 8 did not start simultaneously with any other group, during some portion of the time it was run along with Groups 7, 9 and 10.

Group 9 was fed a diluted milk ration in which it was intended to stir a sufficient amount of grain to make the mixture supply about the same amount of dry matter as would be contained in 14 pounds of skimmilk. This grain mixture consisted of 3 parts hominy, 2 parts standard wheat middlings, 1 part linseed oilmeal (old process), 2 parts red dog flour (wheat) and one-fiftieth of a part of dried blood meal. In addition, this group received the same supplementary grain ration as was fed the group that received skimmilk, i.e., 1 part bran, 2 parts ground oats and 2 parts hominy.

Group 10 was fed a diluted milk ration with silage included in the ration. This was the first and only group in which corn silage was combined with the diluted milk ration. The grain mixture fed was the same as that used for Group 8, viz., 1 part blood meal, 1 part red dog flour, 3 parts ground oats and 3 parts hominy with the exception of the period from the 137th to the 172nd day. During this period of 35 days, a mixture of 3 parts ground oats, 2 parts hominy, 1 part red dog flour and 2½ parts of linseed oilmeal was fed, giving approximately the same nutritive value as the other ration.

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[10] Henry, W. A. and Morrison, F. B., "Feeds and Feeding," 15th Edition.

TABLE XXI.

POUNDS FEED CONSUMED BY GROUP 4.

	Fed to Nos. 107 and 420		No. 107	No. 420	No. 221*
	Grain	Hay	Whole Milk	Whole Milk	Whole Milk
1st mo.	15.9	15.0	115.3	143.1	141.9
2nd mo.	52.3	40.0	141.7	180.3	150.2
3rd mo.	52.0	55.0	189.3	164.2	184.0
4th mo.	53.7	95.4	193.2	155.0	64.4
5th mo.	117.7	180.1	193.2	193.2	—
6th mo.	199.0	208.5	188.1	193.2	—
Total	490.6	594.0	1020.8	1029.0	540.5
Av.†	245.3	297.0	1024.9		
Av. Daily Feed†	1.4	1.7	5.7		

* No. 221 died on 106th day of experiment.

†Includes only Nos. 107 and 420.

TABLE XXII.

POUNDS FEED CONSUMED BY GROUP 8.

	Fed to all 3		No. 226	No. 13	No. 429
	Grain	Hay	Whole Milk	Whole Milk	Whole Milk
1st mo.	42.5	21.7	290.5	290.5	224.0
2nd mo.	84.2	93.3	105.0	105.0	105.0
3rd mo.	164.4	89.3	105.0	105.0	105.0
4th mo.	129.6	176.3	105.0	105.0	105.0
5th mo.	221.1	332.9	105.0	105.0	105.0
6th mo.	206.0	265.0	105.0	105.0	105.0
Total	847.8	978.5	815.5	815.5	749.0
Total of Group	847.8	978.5	2380.0		
Av. of Group	282.6	326.2	793.3		
Av. Daily Feed	1.6	1.8	4.4		

TABLE XXIII.

POUNDS FEED CONSUMED BY GROUP 9.

	Fed to both			No. 228*	No. 610†
	Grain In Milk	Dry Grain	Hay	Whole Milk	Whole Milk
1st. mo.	15.3	21.5	11.1	147.5	214.5
2nd mo.	63.7	63.3	47.8	105.0	99.0
3rd mo.	74.2	76.1	59.5	105.0	63.0
4th mo.	75.0	70.8	105.0	105.0	—
5th mo.	71.3	74.2	134.5	103.0	—
Total	299.5	305.9	357.9	565.5	376.5
Total for Group	299.5	305.9	357.9	942.0	
Av. Daily Feed	1.3	1.3	1.5	4.0	

* No. 228 on experiment 150 days.

†No. 610 on experiment 80 days.

TABLE XXIV.

POUNDS FEED CONSUMED BY GROUP 10.

	Fed to all 3			No. 230	No. 611	No. 612
	Grain	Hay	Silage	Whole Milk	Whole Milk	Whole Milk
1st mo.	12.0	9.0	—	246.5	108.0	284.0
2nd mo.	76.5	63.0	—	105.0	105.0	105.0
3rd mo.	108.3	139.5	140.4	105.0	105.0	105.0
4th mo.	222.3	116.4	696.6	105.0	105.0	105.0
5th mo.	241.5	115.2	527.4	105.0	105.0	105.0
6th mo.	213.6	190.2	1058.1	105.0	105.0	105.0
Total	874.2	633.3	2422.5	771.5	633.0	809.0
Total of Group	874.2	633.3	2422.5	2213.5		
Av. cf Group	291.4	211.1	807.5	737.8		
Av. Daily Feed	1.6	1.2	4.5	4.1		

TABLE XXV.

GAINS IN WEIGHT—GROUPS 4 AND 10.

	Group 4				Group 10			
Calf No.	107	420	221	Av. of Group*	230	611	612	Av. of Group
Birth wt.	76	51	100	63	94	72	84	83
Initial wt.	76	72	103	74	100	98	73	90
1st 4 weeks	18	12	17	15	12	16	25	18
2nd 4 weeks	27	29	30	28	20	35	19	25
3rd 4 weeks	18	21	25	20	26	32	27	28
4th 4 weeks	22	6	19	14	31	36	23	30
5th 4 weeks	35	30	—	32	27	40	33	33
6th 4 weeks	76	62	—	69	44	53	51	49
Last 2 weeks	17	18	—	18	24	34	33	30
Final wt.	289	250	194	270	284	344	284	304
Total gain	213	178	—	196	184	246	211	214
Daily gain	1.2	1.0	—	1.09	1.0	1.4	1.2	1.19

* No. 221 not included.

TABLE XXVI.

GAINS IN WEIGHT—GROUPS 8 AND 9.

	Group 8				Group 9		
Calf No.	226	13	429	Av. of Group	228*	610†	Av. of Group
Birth wt.	83	74	55	71	98	68	—
Initial wt.	90	78	75	81	131	68	—
1st 4 weeks	24	22	17	21	23	16	—
2nd 4 weeks	26	12	28	22	44	8	—
3rd 4 weeks	24	23	14	20	59	8	—
4th 4 weeks	30	27	14	24	50	—	—
5th 4 weeks	46	37	35	39	81	—	—
6th 4 weeks	57	41	50	49	20	—	—
Last 2 weeks	18	9	17	15	—	—	—
Final wt.	315	249	250	271	408	100	—
Total gain	225	171	175	190	277	32	—
Daily gain	1.3	1.0	1.0	1.06	1.8	0.4	—

* No. 228 on experiment 150 days.

† No. 610 on experiment 80 days.

Tables XXI, XXII, XXIII and XXIV give the feed consumed by Groups 4, 8, 9 and 10, all diluted milk groups. Grain, hay and silage (silage fed to Group 10 only) were fed collectively to all calves in each group. The whole milk consumed is given monthly for each calf. Tables XXV and XXVI give the gains in live weight by individuals and by groups for each four week period.

Group 4—The ages of the calves in this group at the beginning of the trial were 14, 10 and 6 days respectively, an average age of 12 days. Reduction of. the whole milk by one pound daily and the introduction of water occurred, until they were getting 14 pounds of liquid in two feeds, 46% of which (6.4 lbs.) was whole milk. They received this at an average age of 19 days. No. 107 at the beginning was quite bright, tho slightly hide bound. With the exception of minor derangements, this calf was always very thrifty, vigorous and growthy. He finished in as good a condition as any calf in the whole experiment. At the beginning, No. 420 showed slight indications of scouring and was somewhat unsteady, not having yet gained full strength. For some time, she did not eat heartily and her hair was standing, but she became vigorous and continued thus thru most of the experiment. On the 83rd day, she refused her food, and on the 95th day showed indications of scouring. No. 221 started in a very vigorous condition altho she soon had a slight attack of bloody scours, but within two weeks she was eating fairly well again. She was always in good condition, yet was more or less sluggish and on the 49th day was off feed. On the 106th day, she was seized with an attack of indigestion from eating new, rather wiry hay and succumbed to it. The two calves that finished the experiment (Nos. 107 and 420) were in better condition as to flesh and bloom than those in any other group. They showed evidence of having had a fairly liberal whole milk allowance. No. 221 that died, would probably have changed the final figures in average gain, for being a Holstein, her gains up to the time of her death were better than those of the Jersey or Guernsey. The two that finished ate on an average 1024.9 pounds of whole milk, 245.3 pounds of grain and 297.5 pounds of hay, amounting to 5.7 pounds of whole milk, 1.4 pounds of grain and 1.7 pounds of hay per day and made an average gain of 1.09 pounds. No. 107 gained 1.2 pounds and No. 420, 1.0 pound daily.

Group 8—This was the first group to complete its course on the 25% dilution. It was fed 10 to 12 pounds of whole milk somewhat longer than Group 7 before being reduced to the dilution, and also had the desired supplementary grain ration from the start. The calves went on the experiment at an average age of 15 days and the milk was reduced beginning at the ages of 28, 25 and 25 days reaching the 25% basis at 37, 31 and 42 days respectively, an average age of 37 days. As with Group 4 no silage was given.

No serious difficulties were encountered with this group. No. 429 scoured a little on the 4th day and again on the 13th day. They developed in quite thrifty condition, tho carrying no surplus flesh. On the whole, they were hardly equal to good skimmilk calves in appearance. On an average they consumed, 793.3 pounds of whole milk, 282.6 pounds of grain and 326.2 pounds of hay, amounting to 4.4 pounds of whole milk, 1.6 pounds of grain and 1.8 pounds of hay per day from which an average gain of 1.06 pounds was secured. No. 226 gained 1.3 pounds and Nos. 13 and 429 gained 1.0 pound each daily.

Group 9—This group received a milk diluted ration of 25%, as did Group 8, the difference, as already described, being that they received grain stirred into the milk. In addition, dry grain as fed to the skimmilk groups, was given. As already explained, No. 430 died from pneumonia a few days after the group was formed. The two calves (Nos. 228 and 610) were placed on experiment at 8 days average age. No. 228 was changed to diluted milk from 44 to 52 days and No. 610 from 16 to 31 days, the two receiving milk completely diluted at an average age of 41 days.

The grain was introduced in small amounts into the milk soon after the experiment started. On the 14th day, No. 228 was scouring and had considerable trouble of this kind thruout. No. 610 scoured on the 25th day and again on the 31st. On the 61st day, her feed was reduced and castor oil was given to check another attack. From this attack she did not fully recover and on the 80th day she was withdrawn from the experiment. No. 228 was also withdrawn on the 150th day. For the combined total of 230 days on experiment, they consumed an average of 4.0 pounds of whole milk and 1.3 pounds of grain in gruel form in addition to 1.3 pounds of grain fed dry; they also averaged to eat 1.5 pounds of hay per day. No. 228 made an average gain of 1.8 pounds and No. 610 0.4 of a pound per day. Thus while one did exceptionally well in the matter of gains the other did exceptionally poor.

Group10—This group was fed a 25% dilution of milk. The grain ration was the same as fed to Group 8, viz., 3 parts hominy, 3 parts ground oats, 1 part red dog flour and 1 part dried blood meal. These calves averaged 12 days of age at the beginning of the experiment and at 22, 23 and 21 days respectively, the reduction of the milk was begun. At an average of 34 days, they had been reduced to a 25% basis, No. 230 alone running over this to the 40th day.

No. 230 on the 9th day was scouring a little. She began eating silage when it was first offered at about 30 days of age and by the 73rd day was eating about 1 pound daily. On the 110th day, grain was more liberally fed and as a result the silage allowance was not eaten up cleanly. No. 611 scoured a little on the 14th day. She began eating silage on the 41st day of age, not having cared for it when it was first offered at 30 days of age. On the 73rd day, she was consuming one

pound daily. No. 612 also began eating silage on her 41st day of age and was consuming a pound daily at 73 days. During the period of feeding, they each consumed an average of 737.8 pounds of milk, 291.1 pounds of grain, 211.1 pounds of hay and 807.5 pounds of silage. An average of 4.1 pounds of milk, 1.6 pounds of grain, 1.2 pounds of hay and 4.5 pounds of silage were eaten per day. From this No. 230 gained 1.0 pound, No. 611 gained 1.4 pounds, and No. 612 gained 1.2 pounds daily, an average gain of 1.19 pounds per day.

RESULTS AND SUMMARY OF GROUPS 4, 8, 9 AND 10.

As described, Group 4 received Jersey whole milk diluted with water after two weeks of age until the milk formed 46% of the 14 pounds of the liquid fed daily. The grain ration was the same as for the skimmilk Groups 1, 2 and 3; Group 8 received a 25% dilution of milk on the 14 pound basis and a special grain ration; Group 9 received the 25% dilution with special grain mixture stirred into the milk and a grain supplement in dry form; Group 10 received diluted milk, the same grain ration as Group 8, and in addition corn silage.

TABLE XXVII.

DIGESTIBLE NUTRIENTS CONSUMED PER CALF BY GROUPS 4, 8, 9 AND 10.

Group	Total Nutrients—lbs.	Nutrients per day—lbs.	Nutrients per pound gain	Nutritive ratio 1 to	Dry matter per lb. gain
4*	506.1	2.81	2.59	6.22	3.19
8	514.0	2.89	2.70	4.81	3.43
9**	615.7	3.42	2.59	6.81	3.21
10	598.3	3.32	2.8	5.55	3.55

* Two calves only; No. 221 died 106th day.

** Two calves only, one of which was on 80 days and the other 150 days.

The digestible nutrients used in Table XXVII, like those in X, are taken from average figures and of course have only a general comparative value. It is here shown that the nutritive ratio is much wider with these rations than with the skimmilk ration, that for Group 4 being 1 to 6.22 and Group 9, 1 to 6.81 compared to 1 to 3.54 for the skimmilk check group (Group 3). The character of the grain ration for Groups 4 and 9 accounts for the wide nutritive ratio, while silage makes the difference of nearly one point between Groups 8 and 10. The nutrients eaten per pound gain are also consistently higher than in the skimmilk group, indicating the superior qualities of an abundance of milk nutrients in producing growth. It is also shown here that the only group receiving silage, Group 10, required more nutrients per pound of gain than the others, as is also the case with the dry matter consumption. This was also true of the skimmilk groups where silage was fed. Group 9, on account of the large amount of grain consumed in the gruel and in dry form was a heavy consumer of nutrients.

TABLE XXVIII

FEED COST, COST PER DAY, AND COST PER POUND GAIN—Groups 4, 8, 9 and 10.

Group	Av. Daily Gain Lbs.	1915-1916 Prices			December 1917 Prices		
		Cost per Calf	Cost per Calf per Day	Cost per Lb. Gain	Cost per Calf	Cost per Calf per Day	Cost per Lb. Gain
4	1.09	$30.33	$0.168	$0.155	$48.40	$0.269	$0.248
8	1.06	26.67	0.148	0.140	42.28	0.235	0.222
9	*	26.68	0.147	0.112	43.30	0.241	0.181
10	1.19	26.59	0.147	0.124	42.40	0.235	0.199

* One calf in 150 days gained 1.8 lbs., the other 0.4 lbs. daily for 80 days.

Considering the results secured as shown by Table XXVIII, it is clear that Group 4 is too expensive. Feeding the larger amount of whole milk simply showed up in the appearance and not in actual development, at least during the period of the experiment. These calves cost $48.40 on a basis of the December 1917 prices (Table XI) and made a pound of gain at 24.8 cents. Groups 8, 9 and 10 cost approximately the same for the six months, Group 8 being lowest at $42.28. The cost per pound of gain was lowest with Group 9, but this group, because of the wide variation in the two calves, must be considered inconclusive. The condition of one of the two calves in this group was such that it had to be removed from the experiment as it was greatly troubled with indigestion. The only other one, the Holstein, being well started when placed on the experiment, made large gains accounting for the low cost per pound. Had the third calf, a Jersey, entered the experiment as planned, the results would probably have been less favorable. The experiment was not carried to completion with the one calf left in it and his influence on the results is apt to cause incorrect conclusions to be drawn. It should be borne in mind that his mate was withdrawn as a result of improper development and numerous digestive disturbances. In trials elsewhere, unsatisfactory results have been secured with grains stirred into the liquid. The difficulty here, as with calf meals, is probably due to incomplete action of the gastric juice upon the food, for arriving at the pylorus in a semi-liquid condition, there is nothing to prevent its hurried entrance into the small intestine when stirred in water. When stirred in milk, the usual coagulation by the rennin is probably interfered with.

Of the four groups, Group 10 made the largest gains, at as low a total cost per calf as any other, and, with the exception of Group 9, at a lower cost per pound of gain (19.9 cents) than any of the other diluted milk groups. In this group, the results are favorable to the corn silage feeding.

TABLE XXIX

SILAGE EATEN BY GROUP 10.

Month	Amount per calf, lbs.	Maximum per day, per calf, lbs.
1st month	—	—
2nd "	—	—
3rd "	46.8	6
4th "	232.2	10
5th "	175.8	10
6th "	352.7	12

The figures in Table XXIX show that no silage was given Group 10 during the first month and in the second the amount eaten at one time was scarcely measurable, so that no actual record of amount eaten occurs before the 3rd month. In the fourth month, the amount reached 232.2 pounds per calf, but this was reduced the next month as growth was not entirely satisfactory and it was desired to induce them to eat more grain and hay. Referring to figures in Table XXIV, it is shown that more grain was eaten the following month, altho the hay was not any greater. In the sixth month, the maximum amount of silage was consumed. Table XXIV also shows that in this month the greatest amount of hay was eaten, while the grain dropped back to less than was received for either the third or fourth months. The average amount of silage eaten daily during the last month was more than 11 pounds.

GENERAL DISCUSSION AND SUMMARY.

It was found that calves readily ate silage, in fact relished it and began to nibble upon it about as soon as they ate hay. Before six months of age, they consumed as much as 10 to 12 pounds daily, especially where it is fed before the hay is given. When silage and grain were placed side by side, many of the calves ate the silage first in preference to the grain.

From our experience, there seems to be no advantage in offering silage to calves under two to three months of age as the amount eaten before that is not great; with many rations, especially of a laxative character, it will increase the chance of scouring. From our experience with a calf meal (Group 6), it does not seem advisable to make use of silage, certainly not until the digestive tract is well developed and the calves have reached three or four months of age. It should be borne in mind that regurgitation is a developing function in the calf and where too much of the feed is difficult of digestion, this important function may not be fully performed.

Corn silage will be eaten in small amounts by calves at a very early age, the more vigorous ones consuming a few pieces at three to four weeks of age. The amount eaten under two months of age is very small, however, and it is better practice not to offer it earlier, as silage will doubtless have an aggravating influence even tho not always actually producing the digestive disturbance.

Silage is relished by most calves and larger gains were made by its use on skimmilk rations. It seems to promote greater consumption of grain, probably because of its palatability and succulent character, and possibly also because of the recognized fitness of the corn plant for growing cattle.

On the skimmilk rations, 14 pounds is the maximum amount fed per day, which is less than that used in most feeding trials and on farms in localities where this product is abundant. The average daily gain by Group 1 (skimmilk, grain, hay, limited silage) was 1.33 pounds, and the cost per pound gain was 10.2 cents—1915-16 prices—and 15.2 cents—1917 prices; Group 3 (skimmilk, grain, hay) gained 1.25 pounds per head per day at a cost of 8.9 cents—1915-16 prices—and 14.7 cents—1917 prices; Group 5 (skimmilk, grain, hay, silage) gained 1.32 pounds daily at a cost of 10 cents per pound—1915-16 prices—and 15.7 cents—1917 prices. The prices for 1917 were those prevailing in December. As pointed out (page 109) Group 5's ration was cheapened by silage but this was offset by a larger amount of whole milk given. Group 10, a diluted milk group, made gains that were not only larger than similarly fed groups but they were made at a lower cost per pound. Silage at $6.00 per ton shows to a greater advantage with the 1917 prices than the $5.00 silage at the 1915-1916 prices. It should be stated that on many farms silage is valued at from $7.00 to $10.00 per ton, and at these prices, it would prove less profitable when fed to calves under six months of age. Where silage is well matured and highly nutritious, its value should be greater, for most of the silage fed to these groups contained more than 75% of water.

The diluted whole milk groups proved more expensive than the skimmilk groups but gains were produced at a price low enough so that such a practice would prove practical on a whole milk market farm, since it eliminates the investment in a separator and the labor involved in separation. After the calves were reduced to the 25% dilution, they received 3.5 pounds of whole milk daily in two feeds, mixed with three times that amount of water. This produced from 1 to 1.4 pounds gain in live weight per day and while these calves were hardly equal in appearance to first class skimmed milk calves, they were more growthy and more thrifty than calves raised on milk substitutes. This milk tested about 5% in fat before dilution; it is impossible to say what results could be expected with Holstein milk diluted to the same degree, altho it might be found that good calves could be raised on the same dilution.

Group 8 was fed on diluted milk (3.5 lbs. daily), grain and hay. They made an average gain of 1.06 pounds at a cost of 14.7 cents—1915-16 basis—and 22.2 cents at the 1917 prices. Group 10 received silage in addition to the feeds given Group 8. This Group made an average gain of 1.19 pounds at a cost of 12.7 cents per pound—1915-16 basis—and 19.9 cents—1917 basis. This group began eating silage about the third month and consumed as much as 12 pounds per head per day in their sixth month. The average amount eaten was 4.5 pounds daily for the entire period.

It is not known what is the most satisfactory grain supplement for the diluted milk. It may be found that certain feeds go together appropriately and a trial of such is at present the best suggestion that can be given. Some difficulty may be found in securing blood meal or red dog middlings at the present time, and it is suggested that a ration consisting of three parts ground oats, two parts hominy, 1 part standard middlings and two and a half parts linseed oil meal could be used. A ration similiar to this was fed for some time to Group 10 with satisfaction.

TABLE XXX

GRAIN, HAY AND SILAGE CONSUMED DAILY BY DILUTED MILK GROUPS COMPARED TO OTHERS.

Feed	Group 1	Group 3	Group 4	Group 5	Group 8	Group 10
Grain	1.4	1.3	1.4	0.9	1.6	1.6
Hay	1.7	1.5	1.7	0.5	1.8	1.2
Silage	1.3	—	—	3.8	—	4.5

The diluted milk groups ate more heavily of grain, hay and silage than those receiving skimmilk. In Table XXX, Groups 1, 5 and 10 received silage. With these groups, the amount of grain and hay eaten, and particularly the latter, is less than that eaten by the other groups, showing that silage did take the place of some of these feeds.

Calves receiving Schumacher calf meal (Group 6) did not relish the silage so much as did the other groups. Silage is probably a hindrance when given earlier than three months of age. The ration fed had a nutritive ratio of approximately 1 to 6 which is wide compared to a normal calf ration with milk, and silage still further unbalances the ration in this respect. Small gains were secured with the Schumacher calf meal and at a higher cost per pound than was secured on the skimmilk ration (4 cents more per pound). Compared with the diluted milk groups the cost per pound of gain was about the same while the average daily gain and total gain was considerably less. The average daily gain was 0.82 pound at a cost of 14.1 cents per pound, basis of 1915-16 prices, and 19.6 cents on 1917 basis. The silage consumed daily was 2.8 pounds.

There was no mineral matter given except common salt. There was noticed a decided tendency on the part of some groups to gnaw the wooden partitions in the pen. Some of them would even eat considerable quantities of shavings, which were used for bedding. This was especially noticable with Group 2 (skimmilk and silage alone) and Group 4 (46% milk dilution). It was also later observed with the other milk diluted groups. Since milk is well supplied with the minerals needed for growth and health, it seems that the lack of it explains the craving exhibited by these groups. This was partially supplied to the groups where blood meal was used.

In our regular calf feeding operations, there is incorporated into the grain mixture, one to one and one half pounds of precipitated bone ash for each 100 pounds of grain mixture. Investigations by Hart, McCollum and Fuller [11] show that inorganic minerals may be utilized by growing pigs, and it is probable that ground limestone or rock phosphate incorporated at the rate of 1 to 3 pounds per hundred of grain would give satisfactory results.

It cannot be said that the diluted milk rations are thoroughly worked out. There is need for more complete data along this line, but due to circumstances, it has not been possible to carry the investigation further at the present time.

[11] Hart, E. B., McCollum, E. V. and Fuller, J. G., "The Role of Inorganic Phosphorous in the Nutrition of Animals," Wis. Research Bul. No. 1 (1909.)

THE COST OF RAISING HEIFERS.

Investigations carried on before the Great War showed that it cost from $80.00 to $100.00 to raise a heifer to two years of age. As an average, this does not take the heifer up to calving time, but it gives a good indication of the cost of bringing a heifer from calfhood up to the period when she begins to give returns. Since no recent figures have been published on this subject, a summary of the items of cost from the work of Trueman [12], Bennett and Cooper [13] and Hayden [14] is given in the following table.

TABLE XXXI

COST OF RAISING HEIFERS TO TWO YEARS OF AGE.

Kind of Feed	Lbs. Feed	Prices 1918	Cost
Whole milk	439	$3.50 per cwt.	$15.37
Skimmilk	2919	1.00 " "	29.19
Grain	1235	60.00 per ton	37.08
Silage	2911	8.00 " "	11.65
Hay	2465	20.00 " "	24.64
Corn Stover	255	8.00 " "	1.02
Pasture	276 days	.03 per day	8.28
Total			127.23

Other Items	Bennett and Cooper	1918 Cost
Value at Birth	$7.00	$10.00
Labor (76.6 hrs.)	8.00	21.06
Bedding	3.00	6.00
Miscellaneous	3.79	7.58
Equipment	.55	1.10
Buildings	2.38	3.57
Interest and Taxes	3.65	5.00
Total		58.31
Grand Total Cost		185.54
Credit—4.5 tons manure @ $4.00 per ton		18.00
Net Cost		167.54

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[12] Trueman, J. M., "The Cost of Feeding Heifers," Storrs Exp. Sta. Bul. No. 63 (1910).

[13] Bennett, C. M., Cooper, M. O., "The Cost of Raising a Dairy Cow," U. S. Dept. Agr. No. 49 (1914).

[14] Hayden, C. C., "Raising Dairy Heifers," Ohio Exp. Sta. Bul. No. 289 (1915).

The feed consumed as shown in Table XXXI is an average of the figures given in the three bulletins mentioned. The other items of cost are more complete in Bennett and Cooper's work and the amounts are taken directly from them. The amounts of manure produced seem to be determined more accurately by Hayden and that figure is taken from him. A value of four dollars per ton is placed on the manure. Some authorities now place manure at a still higher value but it would seem that this price will cover the value of manure produced by heifers for it is known that they utilize the nitrogen and ash more completely in growth than is the case in mature milk producing animals.

The total cost of raising a heifer well to two years of age is therefore found to be $167.54. This emphasizes the necessity of raising only well bred heifers of more than average promise if the undertaking is to prove profitable.

CONCLUSIONS.

Calves will eat silage at an early age, some vigorous ones being able to consume as much as a pound a day by the time they have reached one month of age. In general, it would seem that nothing can be gained by feeding silage to calves at less than two months of age, for the amount eaten is small, and in case of digestive disturbances which frequently occur at this young age, it may prove detrimental.

The group receiving the most silage up to six months of age (Group 10) was first fed it at about two months of age, yet for the entire period they averaged to eat 4.5 pounds daily. During the sixth month, this group consumed 352.7 pounds per calf or an average daily consumption of 11.3 pounds. This was the most satisfactory, from the standpoint of gains and cost, of the five diluted milk groups and it is the only one of these groups that received corn silage.

Most calves relish silage and several of them, after receiving their milk, would choose it in preference to grain. Corn silage, when fed in limited amounts, seemed to increase the appetite for other foods and with one group (Group 1) resulted in larger gains. When corn silage is fed in large amounts, especially in the absence of skimmilk, it will tend to widen the ration more than is usually considered desirable for calves. This can be corrected by feeding a grain mixture containing a larger proportion of protein.

From our experience with one group receiving a milk substitute (Group 6), we conclude that silage is not well adapted in such a ration. These calves did not relish the silage and had considerable digestive trouble. Perhaps silage could satisfactorily enter into the ration at four months of age, but attention should be given to supplying a grain ration with a somewhat narrower nutritive ratio, or preferably one which more nearly supplies the desired combination of amid proteins.

With a skimmilk or diluted whole milk ration, the following amounts of silage daily would probably be consumed advantageously by calves; 2nd to 3rd month—2 pounds; 3rd to 4th month—5 pounds; 4 to 5th month—7 pounds; 5th to 6th month—10 pounds. Should it be desired to push calves more rapidly less silage should be fed leaving more capacity for grain or hay.

A diluted whole milk ration consisting of 46% milk and 54% water having the same fuel value as an equal quantity of skimmilk proved too expensive. A 25% dilution (on a basis of 14 pounds liquid) of Jersey milk which provided 3.5 pounds of milk daily until six months of age, raised calves nearly equal to first-rate skimmilk calves and produced better gains and better looking calves than milk substitute rations. Calves raised on such rations consumed about 700 to 800 pounds of whole milk, and while the cost was as great or greater than was secured with a milk substitute, the gains were larger and they were made at a lower cost per pound.

The question of grain feed has not been fully worked out for rations based upon diluted milk, but it should probably contain more protein (nutritive ratio probably 1 to 4 or 5) and more mineral matter than is ordinarily supplied in a skimmilk supplement. For supplying the minerals, it will probably be well to resort to precipitated bone ash, ground limestone or rock phosphate.

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INFECTIOUS ABORTION IN CATTLE

II. SPECIFIC MEASURES OF CONTROL AND ULTIMATE ERADICATION

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INFECTIOUS ABORTION IN CATTLE

II. SPECIFIC MEASURES OF CONTROL AND ULTIMATE ERADICATION

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THE BULL AS A CARRIER

The possible significance of the bull in the transmission of infectious abortion received considerable attention by early investigators of this disease, particularly Bang and Stribolt. In fact, Bang claimed that disinfection of the sheath was at least one important method of stamping out infection in a herd.

Since Bang's earlier work the problem of eradication has become more and more confusing owing to the various theories and opinions which have sprung up in recent years, and as a consequence the male as an agent in the transmission of infectious abortion has been in a large measure lost sight of.

Our work of the past five years has convinced us that transmission by the male is by far the most important means of spreading the disease. The bull need not become permanently infected, but is merely a passive carrier, transferring the abortion bacteria from infected to hitherto uninfected heifers and cows at the time of service. It appears as if the abortion bacteria may be carried in the sheath of the male for days and perhaps weeks.

Proper disinfection of the sheath, therefore, constitutes the most, if not the only, important safeguard against the spread of infectious abortion. Unless the animals to be bred are from herds which are known to be free from infectious abortion (and relatively few herds of any size are free) such disinfection should always be carried out, preferably both before and after each service. When infection is allowed to spread it will usually cause great losses in the herd before it can be gotten under control; hence, preventive measures should be adopted as soon as possible.

THE CHOICE OF DISINFECTANT

The selection of a disinfectant and the proper method of applying it require considerable attention. A good practical disinfectant should possess the following properties: (1) It must be strongly germicidal in reasonably high dilution. (2) It should act in a short period of time. (3) It must be more or less stable in the presence of organic matter of protein nature. (4) It must be non-irritating and non-poisonous to both the operator and the animal treated. (5) Finally, it must be reasonably cheap. While the following disinfectants have demonstrated their value in their own particular fields, most of them possess certain limitations in connection with the present problem.

Potassium permanganate rapidly deteriorates, especially in the presence of very small amounts of organic matter. Its property of staining objects is also objectionable; and it is expensive, especially at the present moment.

Bichloride of mercury (corrosive sublimate) is very objectionable owing to its instability in the presence of organic matter, and danger from serious poisoning.

Lugol's solution (iodine dissolved in an aqueous solution of potassium iodide) is a powerful germicide. but for internal application it must be used with precaution, owing to its toxic properties. Furthermore, the cost of iodine and potassium iodide makes its choice undesirable. The staining of objects may be added as another objection.

Solutions of hypochlorites like chloride of lime (bleach) and some commercial brands have been recommended and advertised for both internal and external disinfection. These agents are very effective when applied *fresh* and in high dilution, but deteriorate rapidly in the presence of organic matter. Their use in this connection does not appear to us to be as desirable as carbolic acid, lysol and cresol, especially when stored in the dilution in which they are to be used.

Carbolic acid, while a very valuable general disinfectant, here offers in some degree the same objections as does bichloride of mercury, that is, it is more or less irritating and toxic, and is affected by organic matter.

Of the above agents carbolic acid seems best suited for the present purpose. Lysol and cresol are to be preferred, however, to carbolic acid.

Lysol. which has long been in use as a practical disinfectant, is one of the most effective all-round disinfectants on the market. It is a trade product, however, and is much more expensive than *liquor cresolis compositus* or soluble *cresol* which has the same disinfectant value as lysol, and which, like lysol, is practically non-irritating and non-toxic.

Liquor cresolis compositus, or soluble cresol,* can be prepared by any chemist, and may be procured from almost any large drug store or wholesale drug house at a relatively small expense, especially when purchased in one gallon or larger quantities. Cresol solution containing 1 percent of commercial liquor cresolis has been employed by us throughout the course of the present investigation.

PREPARATION OF 1 PERCENT SOLUTION OF CRESOL

To one gallon of water (preferably distilled or rain water) in a large clean jar or can, add 1/3 gill (1/12 pint), or to *four* gallons of the water add 1 1/3 gills (1/3 pint) of the commercial disinfectant, *liquor cresolis compositus.*** Mix well.

If the water is soft (free from lime and magnesia) a clear amber-colored solution is obtained having the characteristic cresol odor. This solution can be applied at once, or stored in a *clean*, closed container for future use.

As cresol is more permanent and has at least twice the disinfectant strength of carbolic acid in the same dilution, a 1 percent solution of the cresol will do the work of a 2 percent solution of carbolic acid or phenol and, therefore, is sufficiently strong for thorough disinfection of the sheath of the male, and of the vulva and vagina of the heifer or cow as well. At the same time it is harmless and non-irritating both to the treated animals and to the hands of the attendants who are applying it. If soluble cresol cannot be obtained readily lysol of the same strength should be substituted.

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*Important. Liquor cresolis, compound solution of cresol, or soluble cresol must not be confused with creolin, insoluble cresol oil, or any other trade product which may in one way or another resemble it.

**Instead of the above measures the following may be employed: 40 cubic centimeters of the cresol in 1 gallon, or 160 cc. of the disinfectant in 4 gallons of water. By weight use 1 ounce of the cresol to every 100 ounces of water.

THE APPARATUS

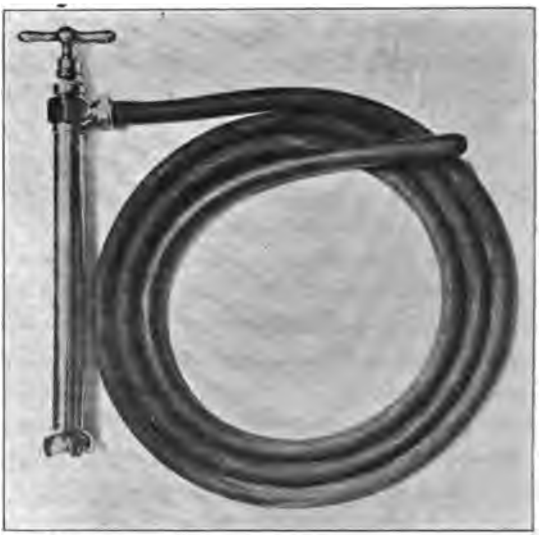

Fig. 1—Continuous Flow Suction and Injection Pump With Rubber Tube Attached

The continuous flow suction and injection pump is the most reliable for disinfection; in fact it appears to be the only dependable agency. The syringe type does not introduce enough liquid into the sheath, nor is it likely to introduce the disinfectant far enough. Injecting two quarts of liquid with it is a tedious operation. The gravity system is slow, and if the funnel is small or not held high enough the liquid will not reach sufficiently far into the sheath to be effective. Probably many attempts to control the disease through disinfection of the bull have resulted in disappointment for this reason.

The pump should be sturdy and dependable. The one shown here is the Garland continuous flow, combination suction and injection pump. It can be secured from almost any supply house, and when properly used should last for several years. A rubber hose with rounded end and 5 to 10 feet in length is desirable. For this purpose a common rubber stomach hose is excellent. It should have an outside diameter of 11/16 inch and a bore of 5/16 inch. The regular-sized stomach tube is somewhat too large for many bulls. The hose should, of course, be non-collapsable. This hose, when properly cared for, will last a long while. The stilet or wooden nozzle which usually accompanies these outfits is of questionable value for disinfecting the genital organs, as it is too rigid and often irritating.

A galvanized 10, 12 or 14 quart pail is desirable for holding the disinfectant to be employed in each operation, and should be used for no other purpose. It will be most convenient to mark it at two quart spaces. The rubber tubing should be thoroughly rinsed in the disinfectant solution after use, particular attention being paid to the end that is inserted in the sheath, and placed with the other apparatus in a clean place, preferably in a closet constructed for the purpose.

A five gallon galvanized kerosene can is admirably adapted for holding the stock solution, and is very convenient. Care should be taken to secure a can having a rather large spigot, so that unnecessary delay in drawing the solution for the operation will be avoided.

The stock solution of disinfectant and the disinfecting outfit, containers, pump and rubber tube, described above, should be protected against dirt and dust, and should at all times be ready for immediate use. The most practical plan is to make up enough of the stock solution of cresol (1%) to last three or four weeks, and keep it in the special jar or can, like the container here illustrated. Only as much of the disinfectant should be drawn off at a time as is to be used in one operation.

After each disinfection, the pump, hose and small pail should be returned clean to their covered shelf or closet where they will be ready for future use. It should be a rigid rule that no part of the disinfecting outfit be used for any other purpose.

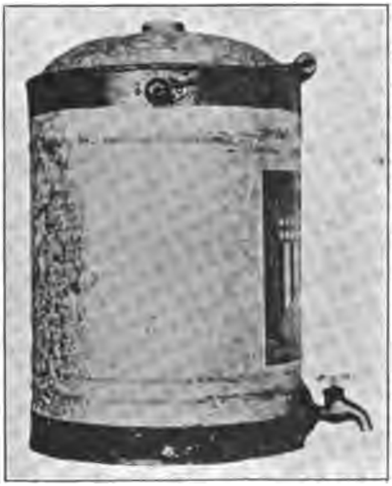

Fig. 2—Five Gallon Oil Can for the Stock Solution

THE TRAINING OF THE BULL

The majority of men look upon any operation connected with handling the bull as a most unpleasant affair, and well they may. But usually the bull is not to blame for the impression of mistrust and fear surrounding him, as a disagreeable disposition is quite naturally the result of insufficient or improper training and lack of exercise.

After he passes the stage of calfhood he is, as a rule, the most neglected farm animal, and many of his thrilling acts are done through sheer ignorance on his part. He no more under-

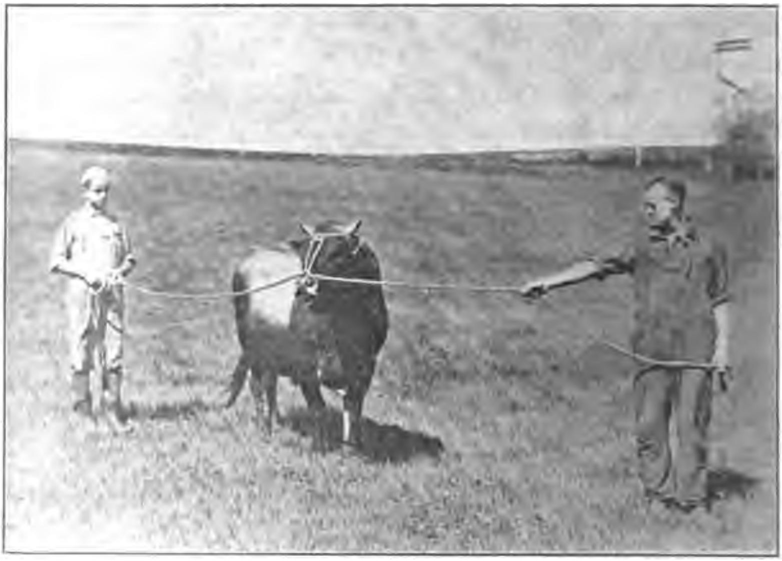

Fig 3—Showing Arrangement for Leading a Vicious Bull. One Rope may be Displaced by the Staff

stands the use of a staff, if applied only when he becomes dangerous, and then only at long intervals, than does the horse understand the rein when he is hitched up for the first time at three years of age and afterwards only a few times a year.

Training the bull to lead not only greatly lessens the danger and agony accompanying the necessary operations, but it is the keynote of successful breeding and dairying. Many well-bred bulls arriving at the point where another year or two would prove their worth through the performance of their daughters, find their way to the block because of the difficulty of handling, or when they cannot be longer utilized in that herd fail to find another owner because they jeopardize attendants and are always looked upon with distrust.

Time spent in teaching him to lead, first as a calf by halter or ring and as a yearling by means of the staff, is time profitably spent and fully justified. No dairy or farm operation deserves more attention. When the bull is thoroughly familiar with the staff, its use meets with a ready response and the animal does not go backwards or double up in some awkward position where, due to his great strength, he makes his keeper as helpless as a leaf in the mouth of a hurricane.

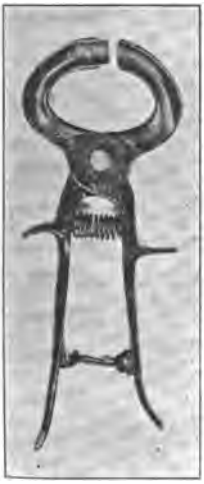

Fig. 4 — Instrument for Ringing Young Bulls

A small 2½ inch ring should be placed in the nose at eight or nine months of age. At a year and a half a three inch ring should replace the first, and from two to three years a large brass ring 3½ inches in diameter should be installed. Rings often show considerable wear after two or three years, and should always be replaced before there is danger of their breaking.

The bull should be given regular and frequent exercise. A strong paddock opening from his stall, preferably not so wide (12 to 25 ft.) but that he can be driven to his stall by the attendant who remains outside of the pen, and containing not less than 750 square feet, should be provided. Bulls that are worked are generally very easy to handle. They should always be handled kindly, but carefully and firmly.

Naturally it is less difficult to accustom the young bull to the disinfecting operation than one that is mature. When the bull is made secure and the operator is not in danger any bull can be taught to submit to the disinfection process. After a while he comes to consider it as a part of the breeding operation. One of the bulls in the College herd (five years old) has reached the stage where he is rather difficult to catch and requires two men to lead, yet after he is once in hand he submits readily to the operation of disinfection, both before and after service. Another bull, now seven years old, passed through a difficult stage of handling at four to five years, but never objected to the disinfection. This particular animal has, by careful handling, developed into a very tractable bull. Neither of the two bulls was handled enough as a youngster. These bulls are disinfected after securely confining their heads in a stanchion or to some secure part of the pen.

The mature bull, at the first disinfecting, can make considerable trouble. It is necessary to have a strong pen or paddock for confining him. It may be desirable or necessary to construct a disinfecting chute in connection with the breeding pen or rack. The chute through which the bull must pass to reach the cow being about 3½ to 4 feet in width, may be so arranged that he can be securely enclosed on all sides long enough to undergo the disinfecting operation, permitting the operator to work from the outside of the chute. When such an arrangement is not available he may be prevented from covering too wide an area with the hind legs, or from kicking, by placing a strong 2″ by 6″ or 2″ by 8″ plank across the pen just below the flank and in front of the hocks, the operator working in front of the board.

It is recommended, and in fact it is quite obligatory, that two persons take part in the operation of disinfection.

HOW TO CARRY OUT THE DISINFECTION

In our work we are disinfecting before and after service. When the disease is active this is undoubtedly the best and safest procedure. The bacteria apparently remain in the sheath for a considerable period of time, and possibly propagate there, so that disinfection before service only may not destroy all of them. Disinfection after service should in most cases destroy all of the *B. abortus* bacteria, but, as has been stated, it should not be depended upon entirely where the disease is active in the herd.

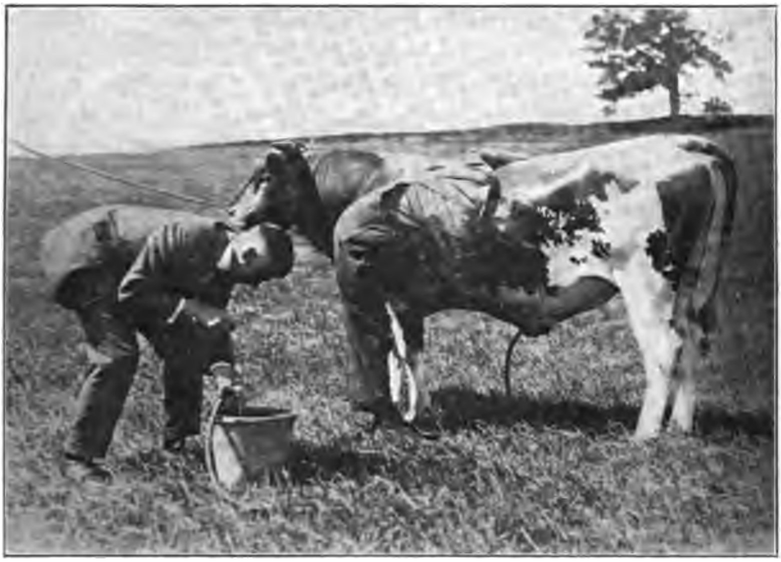

Fig. 5—Disinfecting the Sheath

The amount of disinfectant to be used in each operation with the bull should be two quarts, not less.

In introducing the disinfectant the operator should hold the tube and the end of the sheath with one hand, closing the sheath until it becomes filled, and releasing the opening at intervals to let the liquid run out. The other hand may rest upon the back or hip of the bull for support of the body while bending over. Fully one minute should be consumed in the operation; with the Garland continuous flow pump, by counting to one hundred, moving the lips at each count, about one minute will be consumed if the operator does not become too proficient at counting. If the pump is in good working order two quarts will be delivered in 30 to 35 single complete strokes of the piston. By checking the efficiency of the pump frequently the amount to be delivered can be determined by a count of the strokes.

After disinfection the bull should not be used for fully fifteen minutes, in order to allow the disinfectant plenty of time to work, since time as well as strength is a factor in its effectiveness. The disinfectant will have time also to drain out of the sheath during this interval. The question may arise as to whether the disinfectant will have a deleterious influence upon the semen. There seems to be very little chance of any appreciable amount of disinfectant being introduced into the vagina during service.

The disinfecting tube should be introduced into the sheath from 12 to 15 inches. A mark on the tube at this point will be convenient. The disinfectant may be cold or lukewarm. If it is cold it causes the penis to contract, making the operation much easier. It is not desirable to use it at a temperature lower than 50 degrees F., however, and in winter the stock solution should be kept in a heated room or warmed just before using. It will freeze at a temperature of about 32 degrees F.

For convenience, and as a further protective measure, the long hairs at the opening of the sheath and along the belly in front of the sheath should be clipped. It is advisable also to disinfect the abdomen, especially when the bull is frequently used.

CARE OF FEMALES

This paper would not be complete without a word regarding the handling of the females in the herd. Naturally, and as has been inferred, the greatest attention in prevention is required at the time of service. It is not desirable to disinfect the females at the time of service, as this would undoubtedly render the sperms inactive. Neither does it seem advisable to enter into an extensive plan of individual treatment, involving much labor and expense. In the handling of abortion, as well as other infectious diseases, much benefit is derived from having a well lighted, well ventilated stable, so constructed that it may easily be kept clean.

It seems sufficient to apply a disinfectant to the females only for a short time after a normal calving or after an abortion. Disinfection of the vaginal tract with the same kind of apparatus as is used for the bull (not the same hose), and with a gallon or so of the stock solution, is recommended. The hose should be inserted into the vagina about 18 inches, and the disinfectant pumped in slowly and allowed to run out again. This should be done about three times a week as long as the discharge continues. The rear parts of the cow should be washed or sponged daily for the same period with a 2 to 3 percent solution of cresol or lysol.

The treatment is not presumed to effect a cure, since the cow, if infected, may continue to eliminate the *B. abortus* in small numbers and thus endanger other animals through the service of the male; it should be a great aid, however, in protecting other stock during their association with each other, and should enable the affected animals to conceive with less difficulty.

The aborting animal may be bred as soon as the discharge is arrested, sometimes as early as the first subsequent heat period.

Where suitable quarters are available for isolating the aborting cow, isolation is most desirable for her own comfort as well as for the protection of other stock. But where such facilities are not available and control measures are applied rigidly as directed above, aborting or discharging animals may remain in their accustomed places with little danger of spreading the infection to others. This does not necessarily apply, however, to animals which run loose and mingle in the barn or barn yard, altho we have had little trouble as the result of such mingling.

The aborting animal should not be kept unless she is a good producer, for on account of a diminished flow of milk resulting from the abortion, she is likely to prove a loss, at least until the next calving. On the other hand, cows that are good milk producers should not be sold because they have aborted or are known to be infected with the abortion bacterium. The danger of introducing infection into a herd through newly purchased animals is such that little if anything will be gained by selling high producing cows and by introducing new stock whose ability to produce and whose soundness in so far as infectious abortion is concerned are as yet unknown factors. Some glaring examples have come to our attention recently of failure to improve the condition of a herd by disposing of all the aborting and reacting animals and bringing in new stock. In two instances infection in the new stock was such as to make the problem of eradication as acute as ever.

By proper treatment the elimination of infectious abortion can be brought about in due time. The chief emphasis should be placed on protecting the maturing heifers and young cows which eventually must replace the older members of the herd.

STORRS

Agricultural Experiment Station

STORRS, CONNECTICUT

Bulletin 104, ... September, 1919

THE USE OF FERMENTED MILK AND MILK DIETS TO CONTROL INTESTINAL PUTREFACTION

RICHARD C. FISHER

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THE USE OF FERMENTED MILK AND MILK DIETS IN CONTROLLING INTESTINAL PUTREFACTION.

RICHARD C. FISHER.
Assistant Professor of Dairy Husbandry, Connecticut Agricultural College.

The beneficial action of milk soured by *Bacillus bulgaricus* in controlling intestinal putrefaction has long been recognized. Earlier investigators have generally ascribed this property to the antagonistic action of *Bacillus bulgaricus* in restraining the development of intestinal putrefaction organisms.

According to Metchnikoff (1) *Bacillus bulgaricus* can be implanted in the intestine and has the power to destroy harmful bacteria, such as cause putrefaction of the intestinal contents.

Leava (2) a German investigator, carried on extensive experiments upon himself. He also claims that *Bacillus bulgaricus* can be implanted in the intestine by ingesting large quantities of the organism grown in milk. *Bacillus bulgaricus*, according to his report, was recovered from the feces after the fifth day, and at the same time the amounts of aromatic oxy-acids, and hippuric acid and conjugated acids in the urine were decreased considerably. The decrease of these compounds indicates decreased intestinal putrefaction.

Belonovsky (3) experimented upon mice, feeding them sterilized wheat and cultures of *Bacillus bulgaricus*. After twelve days the character of the intestinal flora showed a marked change from gram-negative to gram-positive organisms and a decrease in gas producers. Examination of the feces however failed to show any predominance of *Bacillus bulgaricus*. He believes that the beneficial action is not due altogether to the *Bacillus bulgaricus* or the lactic acid, but that other products play an important part also.

Cohendy (4) carried on extensive experiments on 30 hospital patients with the use of milk soured by *Bacillus bulgari-*

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(1) Metchnikoff E. Prolongation of Life.
(2) Leava J. Berl. Klin. Wch. Chr. 1908, XIV. 922.
(3) Belonovsky J. Ann. De L' Inst.
(4) Cohendy M. Compt. Rend. Sec. de biol. 1906, LVIII. 602.

cus. His results also show a marked change in the character of the intestinal flora. This change was accompanied by the deodorization of the feces and a decrease in the quantities of conjugate sulphates in the urine. His conclusion is that the beneficial results are due to the *Bacillus bulgaricus.*

Sinclair (5) experimented with milk soured by *Bacillus bulgaricus* on over a hundred children suffering from infant-enteritis and ileocolitis. He also reported a rapid improvement in practically all cases.

Hundreds of other cases could be mentioned proving the value of milk soured by *Bacillus bulgaricus* in the treatment of intestinal disorders. As stated before, earlier investigators generally have ascribed this property to *Bacillus bulgaricus.* Recent experimenters, however, seriously question this as the true explanation, and attach more importance to the influence of diet.

Dr. Rettger (6) of Yale University conducted extensive experiments with young chicks. As in previous cases mentioned, the favorable influence of milk feeding was very striking. Mortality was frequently reduced to at least one half of that amongst chicks receiving no milk. Milk-fed chicks frequently gained twice as much in weight as those not receiving milk. Chicks artificially infected with *Bacterium pullorum* (bacteria causing white diarrhea in chicks) showed a much greater resistance when milk-fed.

However, the same results were obtained whether Bulgaricus Milk or Whole Sweet Milk was fed. His conclusions therefore were that the unique properties of this food exist in milk as such rather than in milk acids or sour milk bacteria that may be present.

His conclusions therefore were that the unique properties of this food exist in milk as such rather than in milk acids or sour milk bacteria that may be present.

Dr. Herter (7) has shown that the products of intestinal decomposition in normal nurslings and bottle-fed children are remarkably small in amount, when the large number of bacteria inhabiting the lower part of the intestinal tract is considered. He also brings out the fact that the intestinal flora in these cases is a very simplified one. Instead of the varied mixed flora of the adult, only a few types are predominent. In breast-fed babies *Bacillus bifidus and Bacillus acidophilus* are predominant while in bottle-fed babies there is an increase in the *Bacillus coli* group and a decrease in the *bifidus* type.

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(5) Sinclair—Medical Record, 1913.

(6) Rettger Leo F. Journal of Experimental Medicine, 21—1915, page 365.

(7) Herter C. A. Common Bacterial Infections of the Digestive Tract.

Bacillus bifidus and *Bacillus acidophilus* are carbohydrate-consuming organisms. They are slow to attack protein, practically having no proteolytic action. Therefore, a simplified intestinal flora with *Bacillus bifidus* and *Bacillus acidophilus* predominating seems to be associated with but a small degree of intestinal putrefaction. The question remains whether the organisms are a causative factor or whether their abundance is due to the influence of certain diets furnishing a preferential medium for their development. To study the possible relation of these organisms to intestinal putrefaction the following experiments were conducted.

I. The production of lactic acid by *Bacillus bulgaricus* and its germicidal effect in milk.

II. The use of fermented milk to control intestinal putrefaction.

III. The use of sweet whole milk in controlling intestinal putrefaction.

IV. The use of $\left\{\begin{array}{l}\textit{Bacillus bifidus}\\ \textit{Bacillus acidophilus}\\ \textit{Bacillus bulgaricus}\end{array}\right\}$ (without milk) in controlling intestinal putrefaction.

V. The effect of lactose feeding on the intestinal flora and on intestinal putrefaction.

METHODS OF PROCEDURE.

ISOLATION AND IDENTIFICATION.

The organisms were isolated from the feces by preparing a 10% suspension of 1 part of fecal material in 9 parts of physiological salt solution. This suspension was then used for further study as follows:

1. *Plating*:—
    - a. Aerobic plates on plain agar, dextrose agar and blood agar.
    - b. Anaerobic plates on plain, dextrose and blood agar containing 0.5% acetic acid.

2. *Gram Stain*:—

    The gram stain was found very helpful because the *Bacillus coli* group is gram-negative, while *Bacillus bifidus*, *Bacillus acidophilus* and *Bacillus bulgaricus* are gram-positive.

    The following technique was observed in making the gram stain:

    The smear was stained for 3 minutes with anilin gentian violet. Then the solution was allowed to run off the slide, but the slide was not washed. Lugol's solution of iodine was applied for 2 minutes. The slide was then rinsed with water and decolorization practiced for ½ minute by means of absolute alcohol. The smear was counterstained with a fuchsin solution.

3. *Inoculation of fermentation tubes containing*:—
    - a. Plain bouillon
    - b. 2% dextrose bouillon
    - c. 2% lactose bouillon
    - d. 2% levulose bouillon
    - e. 2% saccharose bouillon
    - f. 2% peptone bouillon.

    The sugar tubes were used to study the amounts of gas produced from the different sugars. The peptone tubes were used in estimating the amounts of indol and ammonia formed.

4. *Cultural Characteristics on Milk*:—

    Milk tubes were inoculated to study the amounts of acid formed and the action on curd.

5. *Bio-Chemical Study*:—

    To determine the nature and amount of decomposition products, the following tests were made:

100 c. c. of the above suspension of the feces in physiological salt solution were used in the test. This amount was placed in a distilling flask and about 50 c. c. were distilled off. The distillate was then acidified with HCl and extracted three times with 20 c. c. of ether. The ether extract was then evaporated and the residue dissolved in about 10 c. c. of water.

The following tests for phenol, cresol, indol and skatol were then applied:

Phenol and Cresol:--

Millon's test: to 5 c. c. of the solution a few drops of Millon's reagent were added. The presence of phenol is indicated by a white precipitate which turns pink or red on heating.

Indol:—

To 5 c. c. of solution a few drops of glyoxylic acid and H_2SO_4 were added; the presence of indol is indicated by a red color. If formaldehyde is used instead of glyoxylic acid a violet color is produced.

Skatol:—

To 5 c. c. of solution a drop of a weak solution of F_eCl_3 was added and the formaldehyde plus H_2SO_4 test then applied as for indol.

Another test used for indol was to add to 5 c. c. of solution a few drops of B-naptha-quinone-sodium-mono-sulphonate. If indol is present a blue or blue green color forms. Intensity of color depends on amount of indol present.

For skatol Ehrlich's dimethl-amido-benzaldehyde reaction was used in some instances and intensity of color produced as an estimation of relative amounts present.

The original acid water solution left over from the extraction with ether in the separatory funnel was tested for sulphides and ammonia.

CULTURAL CHARACTERISTICS.

I. BACILLUS BIFIDUS.

1. *Source*:
   Feces of breast-fed infants.

2. *Morphology*:—
   a. Cell form:
   Slender bacilli on lactose broth at 37°C.
   b. Characteristic cell grouping:—mostly as individuals or paired.
   c. Irregulàr form:—
   Quite frequently curved or bent in shape of comma. In lactose broth after 24 hours a bifid form was quite common.
   d. No flagella.
   e. Spores:—doubtful.

3. *Staining*:—
   Gram-positive.

4. *Physiology*:—
   a. Temperature best at 37°C.
   b. Anaerobic.
   c. No characteristic odor.
   d. Production of H_2S:—No definite indications after 4 days.
   e. Production of Indol:—No result after 4 days.
   f. Production of Pigment:—None—whitish gray colonies.
   g. Reduction of nitrates:—No definite result—mostly negative.
   h. Action on plain milk: Coagulates cow's milk, but does not coagulate human milk very readily. Has slight digestive properties.
   i. Action on litmus milk:—acid reaction.
   j. Action on dextrose, lactose and sucrose broth:—In all three there was an acid reaction. Production of acid was most rapid in dextrose and lactose broth.

5. *Cultural characteristics*: —
   Bacillus bifidus grows best on dextrose or lactose agar of slightly acid reaction. It also made good growth in lactose bouillon. There was no surface growth.
   The colonies were very slow-growing, and only after three or four days could the tiny white lens-shaped smooth-edged growth be noticed when grown on an acid lactose agar.
   The study of the organism on plate cultures was very difficult because of their anaerobic properties. The morphology varied considerably from time to time. Sometimes difficulty was experienced in distinguishing *Bacillus bifidus* from another anaerobic form known as *Bacillus acidophilus*. The two frequently occurred together in the various cultures.
   To distinguish between the two, tests for production of acid in milk were usually used.

II. *BACILLUS BULGARICUS.*

1. *Sources*:—

   a. Fresh whole milk:—

   Milk directly from the cow was incubated for 18 hours at 21°C. and then for 48 hours at 37°C. This allowed at first the rapid development of the ordinary lactic acid organisms inhibiting the coli or other gas forming types. At the higher temperature and in the presence of the lactic acid already developed the *Bacillus bulgaricus*, if present, rapidly developed. With three to five consecutive inoculations practically pure cultures were obtained.

   Another method was to add about 0.75% lactic acid to the milk at the start and then incubate at once at 37°C.

   b. Commercial cultures:—
   Cultures were obtained from several commercial concerns.

2. *Morphology*:—

   a. Cell-form: Characteristic long slender bacilli after 48 hours incubation at 37°C. in lactose broth.

   b. Cell-grouping: Mostly as individuals or as overlapping threads.

   c. No flagella.

   d. Capsules-doubtful.

   e. No spores.

3. *Staining*:—

   Gram positive: on staining with methylene blue they frequently show granules in the cell.

4. *Physiology*:—

   a. Temperature—Best at 37 to 45°C.

   b. Facultative anaerobes.

   c. Production of H2S:—None.

   d. Production of Indol:—None.

   e. Production of Pigment:—None.

   f. Production of Nitrates:—Slight in milk.

   g. Enzymes:—doubtful.

5. *Cultural characteristics*:—

   a. On broth:—Very meagre growth in medium after 36 hours.

   b. On plain agar:—As a rule colonies resemble typical *B. tetani* colonies.

   c. On dextrose or whey agar:—Slight growth deep in culture tube after about three days incubation. Colonies are almost microscopical in size and show radiating threads. They resemble *Bacillus bifidus* as tiny white lens-shaped colonies except that they are rather saw-edged instead of smooth edged like the *Bacillus bifidus*.

   d. Action on plain milk:—Forms a homogenous curd coagulating the milk in 4 to 24 hours.

   e. Action on dextrose, lactose and sucrose broth was characteristic by formation of acid and no gas. Action is most rapid on dextrose and lactose broth.

f. Amount of acid formed in milk:—The presence of free acid did not inhibit its development. Amount of acid formed varied from 1 to nearly 4% in the different strains. One culture in the laboratory developed a maximum acidity of 3.85%.

III. *BACILLUS ACIDOPHILUS*:—

1. *Sources*:—
   - a. Feces of breast-fed and bottled-fed infants.
   - b. Patients on milk diets.

2. *Morphology*: (very similar to *Bacillus bulgaricus*).
   - a. Cell-form: long, slender bacilli in milk or acetic acid broth.
   - b. Cell grouping: mostly as individuals or as overlapping threads.
   - c. No flagella.
   - d. Capsules—doubtful.
   - e. No spores.

3. *Staining*: gram-positive.
   Old cultures may show several gram-negative bacilli.

4. *Physiology*:—
   - a. Temperature best at 37—45°C.
   - b. Anaerobic.
   - c. Production of H_2S—none.
   - d. Production of Indol—none.
   - e. Production of Pigment—None.
   - f. Production of Nitrates—Doubtful.
   - g. Enzymes—Doubtful.

5. Cultural Characteristics:—
   - a. On broth: little or no growth on ordinary broth but does well on acetic acid broth.
   - b. On plain agar: as a rule colonies resemble typical colonies of *B. tetani*.
   - c. On dextrose or whey agar: slight growth deep in culture-tube after about 3 days incubation.
   - d. Action on plain milk: forms a homogenous curd coagulating the milk in 24 to 36 hours.
   - e. Action on dextrose, lactose, and sucrose was characterized by formation of acid and no gas. Action is most rapid on lactose and dextrose broth.
   - f. Implanted organism can readily be recovered from feces where patient is fed on milk diet; in this it differs from the *Bacillus bulgaricus* which as a rule cannot be recovered from the feces.
   - g. Amount of acid formed in milk: The presence of free acid did not inhibit its development. Did not form acid as rapidly as *Bacillus bulgaricus*, nor was its maximum acidity as high. Acidity varied from 0.6% to 1.9% in different cultures.

THE PRODUCTION OF LACTIC ACID BY *BACILLUS BULGARICUS* AND ITS GERMICIDAL EFFECT IN MILK.

PROCEDURE:

Bacillus bulgaricus produces a high percentage of lactic acid in milk. To determine the germicidal effect of this lactic acid a series of six 500 c. c. Erlenmeyer flasks containing 300 c. c. of milk were used. The milk used was strictly fresh and contained about 0.4% of butter fat. After sterilizing for 20 minutes at 15 lbs. of steam pressure, the flasks were inoculated with cultures of *Bacillus bulgaricus* and incubated at 37° c. The period of incubation depended on the acidity to be developed. The aim was to have six flasks vary in acidity from approximately 0.2% to 2% acidity. They were then sterilized again and titrated for acidity with 0.1 NaOH, using phenolphthalein as an indicator. By this means cultures of milk were obtained which contained the acid as it naturally occurs in the milk. The results it is believed, are more truly representative than when the pure chemical lactic acid is added to the milk.

The *sterile acid milk cultures* so obtained were then inoculated with pure cultures of the following organisms:

1. *Bacillus coli*
2. *Bacillus typhosus*
3. *Bacillus dysenteriae.*

After inoculation, plates were made to determine the initial number of bacteria present, the flasks were incubated at 37° c., the cultures titrated for acidity and plates prepared each day for four consecutive days. The results are tabulated in Table I.

CONCLUSION:

A study of the table shows that none of the cultures studied can survive in milk of over 1% acidity. The growth of *Bacillus coli* was checked at an acidity of 0.75%, while practi-

TABLE I.

SHOWING THE GERMICIDAL PROPERTIES OF LACTIC ACID IN MILK.

	Number of Flask	Acidity of Sterile Culture	ACIDITY OF CULTURES After inoculation for				NUMBER OF COLONIES				
			24 hrs.	48 hrs.	72 hrs.	96 hrs	On inoculation	After inoculation for 24 hrs.	48 hrs.	72 hrs.	96 hrs.
Bacillus Coli	1	0.19	0.34	0.58	0.68	0.75	1.4 Mill.	100 Mill.	500 Mill.	600 Mill.	400 Mi
	2	0.40	0.56	0.68	0.75	0.80	1.8 “	108 “	300 “	500 “	36 ‘
	3	0.70	0.85	1.01	1.03	1.08	1.6 “	89 “	70 “	89 “	500 ‘
	4	0.93	1.00	1.04	1.06	1.05	1.4 “	2000 “	—	—	—
	5	1.12	1.12	1.10	1.09	1.10	1.3 “	100 “	—	—	—
	6	1.63	1.63	1.63	1.00	1.60	1.5 “	—	—	—	—
Bacillus dysenteriae	1	0.22	0.26	0.38	0.56	0.63	1 Mill.	96 Mill.	96 Mill.	58 Mill.	3 Mi
	2	0.42	0.49	0.55	0.64	0.65	1 “	8 “	11 “	3 “	—
	3	0.65	0.70	0.71	0.70	0.69	1.5 “	—	—	—	—
	4	0.91	0.92	0.91	0.92	0.91	3/4 “	—	—	—	—
	5	1.33	1.34	1.33	1.33	1.34	1 “	—	—	—	—
	6	1.56	1.54	1.54	1.55	1.53	1 “	—	—	—	—
Bacillus typhosus	1	0.16	0.28	0.39	0.57	0.69	1/2 Mill.	120 Mill.	110 Mill.	6 Mill.	—
	2	0.41	0.48	0.55	0.63	0.61	3/4 “	—	—	—	—
	3	0.71	0.75	0.74	0.73	0.75	1/2 “	—	—	—	—
	4	0.96	0.97	0.97	0.97	0.97	1/2 “	—	—	—	—
	5	1.25	1.26	1.26	1.25	1.28	3/8 “	—	—	—	—
	6	1.58	1.57	1.56	1.58	1.57	1/4 “	—	—	—	—

Note: Mill. used for abbreviation of Million.

cally all were destroyed at an acidity of 1%. *Bacillus dysenteriae* was checked at about 0.40% and killed at an acidity of 0.55%. The same held true for *Bacillus typhosus*.

Another investigator, P. G. Heinemann, (8) obtained practically the same results except that the amount of acid required to inhibit and kill the organism was somewhat lower in all cases, as is brought out in the following table:

TABLE II.

TABLE II. SHOWING GERMICIDAL PROPERTIES OF LACTIC ACID.

Organism	%Acid necessary to kill according to	
	Heinemann	Fisher
Bacillus coli	0.6	1.00
Bacillus dysenteriae	0.42	0.55
Bacillus typhosus	0.42	0.55
Bacillus diptheriae	0.42	—
Bacillus paratyphosus	0.33	—

As Heinemann used the chemically pure lactic acid, while in the experiments described in this paper lactic acid produced by the metabolism of *Bacillus bulgaricus* was used, a slight difference in results was to be expected.

The experiments bring out the fact that lactic acid in milk has a decidedly germicidal effect in controlling the development of undesirable organisms.

Milk fermented by *Bacillus bulgaricus* usually has an acidity of over 1%. Therefore, the development of the more common pathogenic putrefaction bacteria in it is practically impossible. Its addition to the diet, therefore, may be of value in preventing infection with pathogenic organisms or those causing intestinal putrefaction. Whether or not its germicidal action extends to the control of the organisms already in the intestine is studied in the following experiments.

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(8) P. G. Heinemann—Journal of Infectious Diseases, Vol. 16 No. 3, May 1915, p. 479 to 486.

THE USE OF FERMENTED MILK TO CONTROL INTESTINAL PUTREFACTION.

PROCEDURE: The milk used in this experiment was whole milk of Grade A quality. It was pasteurized by heating to 145°F and holding for thirty minutes. Half of the milk was then cooled to 100°F and inoculated with a pure culture of *Bacillus bulgaricus*, while the other half was inoculated with a pure culture of *Bacillus lacticus*, at 70°F. After about 18 hours of incubation at the respective temperatures the milk was again put together in a small hand churn and churned for about ten minutes. The milk was then cooled, bottled and stored in a refrigerator till used. The addition of *Bacillus lacticus* culture moderates the acidity and takes away the sharp, puckering taste of a pure *bulgaricus* culture. This fermented milk, which had an acidity of about 1.10% was fed in connection with a regular diet of meat, cereals and vegetables. As a natural result of consuming from two to four quarts of milk the quantity of other foods used was very materially reduced. This diet was continued by five persons for 28 days. Observations were made on the nature of the intestinal flora. Feces and urine were examined during and after the experiment for indol, skatol, and indican. Records were kept as to movement of bowels and general welfare of the patient as indicated by gain or loss in weight.

RESULTS: Five out of six completed the experiment, practically all of whom showed an increase in weight and improvement in physical condition. One of the patients was forced to discontinue the fermented milk diet due to stomach trouble. At the beginning of the experiment two of the patients selected suffered slightly from indigestion, while all suffered more or less from constipation. All reported a great improvement in the movement of the bowels. Examination of the feces and urine showed a marked decrease in putrefactive decomposition products. The relief from constipation may have been an important factor in causing a decrease in the decomposition products. Table 3 is a summary of the results:

TABLE III.

EFFECT OF FERMENTED MILK IN THE DIET.

Patient	Intestinal flora		Decomposition Products		Constipation		Weight	
	Before	After	Before	After	Before	After	Before	After
1	+ — —	+ + —	+ +	+	+ +	— —	165	168
2	+ — —	+ + +	+ + +	+ + —	+ + +	— —	119	124
3	+ — —	+ + —	+ +	— —	+	— —	133	134
4	+ — —	+ + —	+ + + +	+ — —	+ + + +	— — —	141	150
5	+ — —	+ + —	+ +	+ —	+ + +	+ + +	130	129½
6	+ — —	+ + —	+ + +	+ + —	+	—	154	154

Note: Gram negative is indicated by: —
Gram positive is indicated by: +
Patient No. 5 discontinued experiment after 5 days.

The intestinal flora in all cases changed from a predominance of gram negative to a flora which showed a large number of gram positive organisms. Attempts were made to recover *Bacillus bulgaricus* from the feces. The results were unsuccessful in practically all cases. Several times gram-positive organisms resembling *Bacillus bulgaricus* were isolated. These organisms answer the description of the *Bacillus acidophilus* of Moro. They are very similar to *Bacillus bulgaricus,* but do not form acid as rapidly nor is the maximum acidity as high. The principal point of difference is that *Bacillus acidophilus* can readily be recovered from the feces, while *Bacillus bulgaricus* cannot.

When grown in milk *Bacillus acidophilus* frequently developed an acidity of 1.5%. Formation of acid in milk was slower than by a typical culture of *Bacillus bulgaricus.* The results of growing *Bacillus acidophilus* are shown in Table IV.

TABLE IV.

FORMATION OF ACID IN MILK BY BACILLUS ACIDOPHILUS.

Inoculation	Initial Acidity in Milk	After 24 Hrs.	After 48 Hrs.	After 72 Hrs.
1st	0.15	0.43	0.60	0.65
2nd	0.17	0.49	0.61	0.69
3rd	0.16	0.63	0.80	0.81
4th	0.21	0.53	0.77	0.85
5th	0.15	0.75	0.87	0.93
6th	0.15	0.75	0.97	1.09
7th	0.17	0.83	1.01	1.19
8th	0.16	0.90	1.34	1.58

These results are an average of six different strains. The highest reached an acidity of 1.97% in 72 hours.

Bacillus acidophilus was a common inhabitant of the intestinal tract as long as fermented milk was regularly fed. As soon as its use was discontinued the intestinal flora gradually changed from a gram positive flora to one in which large numbers of gram negative organisms were present.

CONCLUSION: The results indicate that fermented milk added to the diet in considerable quantities has the power to change the intestinal flora with accompanying beneficial results in the general well-being of the patient. As to the cause of this remarkable change in the intestinal flora it appears that fermented milk in some way provides a preferential medium for the *Bacillus bifidus* and *acidophilus* types. Either the high acidity prevents the development of the other types of bacteria, or milk contains some food element which provides an excellent medium for rapid development of *Bacillus bifidus* and *acidophilus* to the exclusion of others. That the latter is the most probable explanation is brought out in the succeeding experiments where sweet whole milk was used instead of fermented milk.

THE USE OF SWEET WHOLE MILK TO CONTROL INTESTINAL PUTREFACTION.

PROCEDURE: The procedure of the experiment was the same as where milk fermented with *Bacillus bulgaricus* was used. All tests and observations were made under as nearly identical conditions as was possible to attain. This time, however, sweet whole milk meeting the certified requirements was used. Six patients were fed for a period of 28 days on a regular diet of meat, cereals and vegetables in reduced quantities to allow for the additional food furnished by the daily use of two to four quarts of milk.

RESULTS: The intestinal flora showed the same marked change as when feeding *bulgaricus* milk. It took from eight to ten days before the slides showed considerable numbers of gram positive organisms of the *bifidus* and *acidophilus* types. There was a decrease in decomposition products. However, patients suffering from constipation were not relieved as they were on the *bulgaricus* milk diet. The results are shown in Table V.

TABLE V.

EFFECT OF SWEET WHOLE MILK IN THE DIET.

Patient	Intestinal Flora		Decomposition Products		Constipation		Weight	
	Before	After	Before	After	Before	After	Before	After
1	+ — —	+ + —	+ +	+ —	+ +	+ —	166½	167½
2	+ — —	+ — —	+ + +	+ — —	+ + +	+ + —	121	127½
3	+ — —	+ + +	+ + +	+ + +	+ —	+ +	133	133½
4	+ —	+ + —	+ + +	+ + —	+ + + —	+++—	147	146
5	+ — —	+ + +	+ +	— —	— —	— —	134	139
6	+ — —	+ — —	+ + + +	+ — —	+ —	— —	153½	155½

Clinical symptoms and general health improved and there was a gain in weight with the exception of two patients who reported severe constipation as a result of the milk diet. Others, however, reported a laxative effect from the milk.

CONCLUSION: The experiment seems to indicate that a diet of sweet whole milk brings about the characteristic change in the intestinal flora observed when feeding fermented milk. *Bacillus bulgaricus* or the lactic acid in milk, therefore, cannot be credited with this change in intestinal flora and the decrease in decomposition products formed. Sweet, wholesome milk as such seems to provide a medium which favors the development of those organisms associated with a minimum amount of intestinal putrefaction. Persons suffering from constipation, however, may do well by using *bulgaricus* milk which seems to provide an effective remedy for constipation.

THE USE OF *BACILLUS ACIDOPHILUS*, *BACILLUS BULGARICUS* AND *BACILLUS BIFIDUS* TO CONTROL INTESTINAL PUTREFACTION.

PROCEDURE: Pure cultures of *Bacillus acidophilus*, *Bacillus bulgaricus* and *Bacillus bifidus* were grown on dextrose agar. Watery suspensions of the bacilli were then made from these dextrose cultures. These watery suspensions were mixed with the food and thus ingested. Six patients followed a regular diet of meat, cereals and vegetables, but no milk was used during the four weeks of the experiment. All other conditions of the experiment were the same as when fermented and sweet whole milk was fed.

RESULTS: No appreciable change could be noticed in the amount of decomposition products produced. The slides showed some gram positive bacteria, but large numbers of gram negatives were present throughout the experiment. The persons on test did not experience any favorable or unfavorable results from the ingestion of the large numbers of organisms. Results are indicated in Table VI.

TABLE VI.

EFFFCT OF WATERY SUSPENSIONS OF *BACILLUS BULGARICUS*, *BACILLUS ACIDOPHILUS* AND *BACILLUS BIFIDUS*.

Patient	Intestinal Flora		Decomposition Products		Constipation		Weight	
	Before	After	Before	After	Before	After	Before	After
1	+ — —	+ + —	+ +	+ +	+ —	+ —	144	144½
2	+ — —	+ — —	+ —	+ —	+ —	+ —	151	153
3	+ — —	+ — —	+ +	+ —	— —	— —	152	151½
4	+ — —	+ — —	— —	+ —	— —	— —	121	120
5	+ — —	+ + —	— —	— —	+ —	+ —	134	136
6	+ — —	+ + —	+ —	+ —	+ —	+ —	146	148

CONCLUSION: *Bacillus bulgaricus* and *Bacillus bifidus* supplied to the diet in the form of watery suspensions only temporarily effect the intestinal flora. They do not cause any marked decrease in the production of intestinal decomposition products. Their implantation without milk in the intestinal tract is very doubtful. The series of experiments seems to show that milk is necessary to establish *Bacillus bifidus* and *Bacillus acidophilus* in the intestinal tract. The benefit derived from the use of fermented milk, therefore, must be credited to the milk diet. The characteristic change of the intestinal flora to the *bifidus* and *acidophilus* types is in some way associated with the use of considerable quantities of milk.

Dr. Rettger (9) suggests that milk owes this property to the lactose which it contains. In his experiments on white rats those which were fed lactose showed the characteristic change from the gram negative to the gram positive slides with *Bacillus bifidus* predominating. Other rats fed on sucrose, maltose, dextrose, and levulose failed to show this change in the intestinal flora. To compare the feeding of lactose with the previous experiments where milk was fed, the following experiment was conducted.

THE EFFECT OF LACTOSE ON THE INTESTINAL FLORA AND ON INTESTINAL PUTREFACTIONS.

PROCEDURE: In so far as possible other sugars were withheld. The amount used averaged from 150 to 215 grams per day, which is the equivalent contained in three to four quarts of milk. The lactose was mixed with other foods and thus eaten. No milk was used during the experiment. Tests and observations were made under as nearly identical conditions as in the previous experiments.

RESULTS: The slides prepared from feces were practically gram negative at the beginning of the experiment. After the first two weeks a few gram positive organisms were present. Thruout the experiment, however, large numbers of gram negative organisms mostly of the coli type, remained.

Clinical observations were practically the same as before the experiments. Those slightly afflicted with constipation remained so thruout the experiment. There was no appreciable gain or loss in weight. Results are shown in Table VII.

TABLE VII.

EFFECT OF USE OF LACTOSE ON

Patient	Intestinal Flora		Decomposition Products		Constipation		Weight	
	Before	After	Before	After	Before	After	Before	After
1	+ — —	+ — —	+ +	+ +	+ —	+ —	166	167
2	+ — —	— — —	+ —	+ —	+ +	+ +	153	152
3	+ — —	+ + —	+ +	+ —	— —	— —	141	140½
4	+ — —	— — —	+ +	+ —	— —	— —	119	119½
5	+ — —	+ — —	+ +	+ —	+ —	+ —	138	139
6	+ — —	+ — —	+ —	+ —	— —	— —	154	155

CONCLUSION: The feeding of lactose changes the intestinal flora from a gram negative to one in which considerable numbers of gram positive organisms of the *Bacillus bifidus* and *acidophilus* types are present. This in connection with a slight decrease in decomposition products seems to point out that lactose is an important factor as a controlling agent in intestinal putrefaction. The best results, however, are obtained by using a milk diet in the form of fermented milk or sweet whole milk.

GENERAL DISCUSSION AND CONCLUSION.

One of the most striking facts to be noticed in the series of experiments is the characteristic change in the intestinal flora coupled with decreased intestinal putrefaction whenever milk constituted a large part of the diet. In these cases the intestinal flora changed from the usually gram negative coli type to one in which the gram positive aciduric *Bacillus acidophilus* was prominent. In all instances where milk made up the principal part of the diet there was a marked decrease in the decomposition products.

The first experiment deals with the germicidal effect of lactic acid in milk. Pathogenic bacteria introduced into milk cultures containing 1% lactic acid were effectively checked and destroyed. This proves that lactic acid has decided germicidal properties, and may prevent the infection of fermented milk with harmful organisms. The results of the other experiments, however, seem to indicate that this germicidal action of lactic acid does not extend to the control of the organisms already in the intestine.

The results from the use of *Bacillus bulgaricus* milk in connection with a regular diet were very gratifying. Intestinal putrefaction decreased markedly when at least two quarts of *bulgaricus* milk were used and the other food reduced proportionately. There was a general gain in weight, and those suffering from constipation were very much relieved. Of special interest is the change in the intestinal flow. Notwithstanding the fact that very large numbers of *Bacillus bulgaricus* were ingested with the milk, only a few could be recovered from the feces. *Bacillus bulgaricus* is therefore not a natural inhabitant of the human intestinal tract. The very closely related *Bacillus acidophilus* could be found in large numbers, but only after about eight or ten days use of the *bulgaricus milk.* When milk was discontinued the *Bacillus acidophilus* gradually disappeared and the flora again showed large numbers of the gram negative organisms.

The same held true with the whole sweet milk experiment, which gave practically as good results as *bulgaricus* milk. This fact becomes still more significant when it is considered that *Bacillus acidophilus* became a common inhabitant of the intestinal tract without the ingestion of the organism itself. This would indicate that *Bacillus acidophilus* is naturally an intestinal organism, and that its presence or absence is dependent upon the nature of the food consumed. The diet or nature of the food then is the controlling factor. The character of the intestinal flora is dependent on, and alters with, the type of the food. The ingestion then of large numbers of certain bacteria without the proper diet can be of little permanent value. This fact was brought out by the experiment in which watery suspensions of *Bacillus bulgaricus*, *Bacillus acidophilus* and *Bacillus bifidus* were consumed. The intestinal flora thruout the experiment showed large numbers of the gram-negative types, and there was no appreciable decrease in the decomposition products.

The use of lactose in bringing about decreased intestinal putrefaction gave fair results, but they cannot compare with the remarkable results obtained by the use of *bulgaricus* or sweet milk. The beneficial effect of milk in the successful treatment of various intestinal diseases as typhoid fever has for some time been known to the medical profession, but not until recently has it been realized that the explanation lay in its ability to change the intestinal flora from the putrefactive type to the gram positive aciduric *Bacillus acidophilus* group, the presence of which is associated with a minimum amount of putrefaction and the general well-being of the individual. Whether *bulgaricus* milk or fresh sweet milk is preferable depends upon the conditions. If the subject is constipated the *bulgaricus* milk may prove very helpful. On the other hand, some individuals apparently do not tolerate acid milk, and in such cases the sweet milk would be best. Approximately three to four quarts should be used daily, in half pint quantities taken every hour or two. Other foods should be reduced proportionately, and in certain cases it may prove advisable to leave them out entirely and increase the milk to four or even six quarts, depending on the needs of the patient.

There may be conditions when it is advisable to have in the intestines at once large numbers of the *Bacillus acidophilus*. It seems that a fermented milk prepared with *Bacillus acidophilus* would be admirably suited for such needs. Instead of using the *bulgaricus* culture an *acidophilus* culture could be used, thus providing both the essential factors, milk, and the large numbers of the desirable organism which is a natural inhabitant of the intestinal tract.

Much work remains to be done, and the writer hopes to continue the experiments which were interrupted during the war. So far the work has brought out the importance of the diet in controlling intestinal putrefaction and disorders. It was shown that a change in food alters the nature of the intestinal flora, and that milk is the one food which can bring about so characteristic and beneficial a change in the intestinal flora from the putrefactive to the *acidophilus* type. Already the medical profession is using nature's own food, milk, to combat various diseases, and will continue to do so in the future, as the importance of the diet and nutrition in the successful combatting of disease is realized.

The experiments discussed in this paper were conducted in the Dairy Laboratory of the Ohio State University, Columbus, Ohio, during the years 1917 and 1918.

WEATHER REVIEW FOR 1918

BY H. D. EDMOND.

Observations have been taken for the past thirty-one years.

GENERAL OBSERVATIONS.

The extremely cold weather beginning with the last week of November 1917 extended through January and February of this year. The mean temperature for January being 18° or 8.31° below normal.

May and June had high mean temperatures which were respectively 4.98° and 5.42° above the average. July was cool with a mean of 14.85° below normal. The mean temperatures for the remainder of the year, with the exception of September were above normal. The rainfall for the year with the exception of June and September was below normal. September had a heavy rainfall of 7.77 inches or 4.08 inches in excess. The rainfall for the year was 3.95 inches less than for the thirty year mean.

TEMPERATURE FOR 1918.

The mean temperature for the year was 47.30 corresponding with the 30 year mean. January was a very cold month with a mean temperature of 18° or 8.31° below normal. On the 1st and 2nd the highest temperature was -5° and the lowest -12° and -9° respectively. These were the coldest days of the year. February continued cold with a temperature of -11° on the 2nd and -9° on the 5th and 6th. The mean temperature was 2.77° above normal. The temperature for March was 3.02° above the mean. The lowest temperature was 5° on the 11th and the highest 74° on the 21st. The last spring frost was on April 25th with a temperature of 31°. The temperatures for the month were normal. May temperatures were high. The mean being 4.98° above the average. The warm weather continued through June with a mean temperature of 5.42° above normal. The mean for July was 14.85° below normal. There was a hot period from the 15th to 29th with a temperature of 97° on the 22nd and 96° on the 23rd. The highest temperature in August was 94° on the 7th. The September mean was 2.41° below normal but there were no frosts. The first killing frost was on October 19, with a temperature of 29°. The month of November was a little warmer than usual. There was a hard freeze on the 7th with a temperature of 24°. From the 22nd on, there was freezing weather. December had a mean temperature of 5.54° above the average. The lowest temperatures were during the first and last weeks. The lowest was 8° on the 6th.

RAINFALL.

The rainfall was 3.95 inches less than the 30 year average. January was nearly normal. February was 1.37 inches less than the average. There was no rain in March after the 15th. The total for the month was 1.74 inches less than normal. The rainfall for April was nearly normal and well distributed. The rains in May were nearly normal. The June rains were in two periods, from the 10th to 14th and 22nd and 23rd and 1.52 inches below the average. There was a very heavy rain on the 22nd of 2.1 inches. July was a very dry month for it only rained during the last two days. The August rainfall was normal, most of it coming during the first half of the month. The September rainfall was very heavy a total of 7.77 inches or 4.08° above the mean. October and November were dry months with 0.93 and 0.91 inches respectively. December had its usual amount of snow and rain.

THE GROWING SEASON.

The growing season is the period between the last killing frost in the Spring and the first killing frost in the Autumn. It is usually of five months duration or from about May 1 to October 10. In this latitude a killing frost is liable to occur near the middle of May or September which naturally shortens the growing season. This year the growing season was from April 25 to October 19 or a period of 176 days which allowed the full maturing of all crops.

METEOROLOGICAL OBSERVATIONS FOR 1918

Temperature and Rainfall	January	February	March	April	May	June	July	August	September	October	November	December	Total	Average
Highest	46	59	74	75	86	89	97	94	84	77	70	61		
Lowest	—12	—11	5	25	35	38	46	46	39	29	15	8		
Mean	18	27.5	37.3	46.9	61.1	62.9	54.5	68.9	58.6	54.1	41.4	35.5		47.3
Total precipitation, inches.	3.71	2.32	2.37	3.08	2.74	4.29	3.01	3.87	7.77	0.93	0.91	3.53	38.53	
No. days with .01 inch or more precipitation	9	10	7	11	9	6	5	7	9	5	4	6		

Growing season Apr. 25 to Oct. 19, 176 days.

MONTHLY MEAN TEMPERATURE FOR PAST 27 YEARS.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Mean
1892	25.5	26.9	29.9	44.9	53.6	67.0	69.2	67.4	59.1	48.5	37.6	25.5	46.3
1893	17.3	23.5	30.3	42.0	54.5	64.2	67.9	68.0	55.9	51.7	38.1	27.8	45.1
1894	27.7	23.0	38.6	44.7	56.4	66.0	70.9	65.8	63.0	50.6	34.1	28.2	47.4
1895	24.4	19.9	31.1	41.1	57.3	66.6	66.1	68.3	63.1	45.0	41.7	32.6	46.7
1896	21.8	26.3	28.5	47.5	59.9	63.2	69.6	68.5	59.9	47.2	43.5	26.8	46.9
1897	25.0	27.0	34.0	46.0	56.0	62.0	69.0	66.0	60.0	51.0	39.0	31.0	47.2
1898	25.0	28.0	40.0	42.0	54.0	64.0	70.0	69.0	63.0	52.0	38.0	29.0	47.8
1899	25.0	22.0	31.0	45.0	56.0	57.0	68.0	67.0	59.0	52.0	39.0	31.0	46.8
1900	27.0	26.0	30.0	46.0	55.0	66.0	71.0	69.0	64.0	54.0	41.0	29.0	48.2
1901	25.0	19.0	33.0	45.0	34.0	67.0	71.0	66.0	62.0	50.0	33.0	29.0	46.2
1902	24.0	25.0	41.0	46.0	55.0	64.0	66.0	66.0	59.0	48.0	44.0	23.0	46.8
1903	26.0	27.0	43.0	45.0	58.0	59.0	68.0	61.0	60.0	51.0	38.0	23.0	46.8
1904	18.0	18.6	34.1	42.9	59.7	63.4	68.7	65.9	59.9	48.1	35.6	22.4	44.8
1905	20.5	19.3	34.1	44.8	57.0	64.0	71.5	66.0	59.7	53.6	38.0	32.5	46.8
1906	31.9	26.9	28.9	45.9	56.7	65.3	69.8	70.5	63.6	52.2	39.6	26.4	48.1
1907	25.4	19.0	35.8	41.4	50.7	62.0	71.6	65.9	61.9	49.4	40.2	33.8	46.43
1908	27.8	24.8	33.9	47.3	59.2	66.7	71.6	66.6	63.4	54.9	37.0	30.3	48.6
1909	28.6	31.1	32.8	46.6	55.7	66.4	67.4	67.5	60.4	50.2	44.5	26.6	48.15
1910	27.8	27.5	43.4	53.7	56.8	63.3	71.7	66.4	61.9	53.8	38.0	24.1	49.05
1911	29.6	25.4	39.0	44.5	61.8	64.5	73.1	67.9	61.4	49.7	38.0	34.8	48.65
1912	17.6	24.5	33.5	46.0	57.9	64.1	70.6	69.3	61.0	53.0	44.9	35.3	48.14
1913	36.5	25.6	42.0	48.1	54.4	64.7	70.8	68.6	60.3	57.0	44.2	36.4	50.71
1914	26.5	20.7	33.4	44.4	59.5	64.3	66.8	68.7	62.2	55.8	39.6	25.9	47.31
1915	29.8	30.1	33.3	50.7	54.9	66.7	69.8	66.0	65.0	52.9	41.9	28.7	49.15
1916	31.2	21.8	26.2	44.7	56.2	60.7	73.0	70.2	62.1	53.6	39.1	28.8	47.30
1917	26.5	23.5	34.5	43.	49.	64.5	70.5	72.	56.	47.5	35.5	21.	45.12
1918	18.0	27.5	37.3	46.9	61.1	62.9	54.5	69.9	58.6	54.1	41.4	35.5	47.31
*Mean	26.03	24.82	34.34	45.54	56.28	64.43	68.87	67.43	60.93	50.72	39.25	30.14	47.26

* The mean temperature includes data for 31 years.

TOTAL MONTHLY PRECIPITATION FOR PAST 27 YEARS

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Precipitation
1892	4.91	1.60	3.00	0.70	5.60	2.77	3.25	5.20	1.40	1.09	5.41	1.35	36.28
1893	2.39	5.88	4.67	3.82	7.12	1.98	1.58	3.79	2.58	6.71	2.45	3.68	46.65
1894	2.24	3.13	1.18	2.67	3.58	0.59	2.09	2.37	3.01	4.16	4.00	4.31	33.33
1895	4.78	0.63	2.62	4.27	2.16	1.78	4.13	3.48	2.97	6.74	6.97	4.12	44.65
1896	1.60	7.10	4.86	0.80	2.72	1.78	3.22	2.71	7.03	3.60	2.29	2.67	40.38
1897	3.84	2.70	3.66	2.37	4.44	2.79	12.24	5.23	1.39	0.92	7.14	5.61	52.33
1898	4.70	4.03	3.09	4.44	3.81	2.48	6.24	5.87	2.22	6.18	6.11	1.96	51.13
1899	3.76	3.97	5.58	2.20	1.17	3.72	5.55	3.27	3.31	1.54	2.10	2.14	38.31
1900	3.42	7.31	6.43	2.67	4.91	4.32	2.76	2.03	2.27	3.21	7.03	2.22	48.58
1901	8.50	1.05	7.18	9.51	6.30	1.96	6.54	7.58	4.33	1.97	3.04	9.55	66.51
1902	2.53	5.11	6.35	3.88	1.73	3.25	7.48	2.16	7.05	5.68	1.11	6.30	52.63
1903	3.73	5.18	7.09	2.81	0.50	9.24	4.56	4.52	1.81	2.79	1.95	4.27	48.45
1904	4.55	2.80	3.31	6.40	1.96	2.53	1.85	6.00	4.71	2.19	1.47	2.42	40.19
1905	3.57	1.21	3.45	2.87	0.90	4.53	1.77	2.63	5.79	2.57	2.73	4.12	36.14
1906	3.16	2.68	5.46	4.40	5.87	2.18	5.03	2.16	2.65	4.85	2.39	2.80	43.63
1907	3.13	0.37	1.68	2.40	3.16	2.81	1.43	1.09	9.61	4.97	6.42	5.28	42.35
1908	3.26	5.70	3.51	1.56	6.57	2.42	5.37	5.91	1.45	1.84	0.80	3.69	42.08
1909	2.77	6.95	3.99	4.38	3.89	2.02	0.84	2.01	5.32	1.58	1.73	3.82	39.30
1910	5.73	3.93	1.31	3.20	1.50	4.88	2.24	1.99	4.66	1.42	3.51	2.39	36.76
1911	2.34	2.73	3.56	2.98	0.33	1.20	3.46	5.50	2.94	6.24	4.92	3.53	39.73
1912	1.43	2.10	7.29	3.61	4.38	0.29	3.62	5.49	2.33	1.97	3.81	5.20	41.52
1913	3.95	3.00	5.86	4.80	3.35	2.32	4.25	3.55	2.60	5.72	2.05	4.13	45.58
1914	2.90	3.67	4.69	4.27	2.40	1.53	3.79	1.48	0.45	3.28	3.02	3.33	34.81
1915	7.52	4.41	0.15	1.18	2.64	0.93	8.28	5.92	1.51	2.71	2.93	2.49	40.67
1916	1.46	5.98	1.92	1.93	4.43	4.48	10.85	0.93	2.49	2.33	3.30	2.60	42.70
1917	2.86	3.29	4.84	1.87	3.00	4.05	2.65	7.06	1.13	6.12	0.47	2.83	40.17
1918	3.71	2.32	2.37	3.08	2.74	4.29	3.01	3.87	7.77	0.93	0.91	3.53	38.51
*Mean	3.80	3.64	4.05	3.31	3.37	2.82	4.46	3.89	3.82	3.69	3.38	3.79	43.80

*The mean precipitation includes data for 31 years.

WEATHER REVIEW FOR 1919

BY H. D. EDMOND.

Observations have been taken for the past thirty-two years.

GENERAL OBSERVATIONS.

A new record for the greatest daily range of temperature was made this year on October 29 when the difference between the lowest temperature of 36° and the highest of 86° was 50°. The highest previous record was 49° on April 6, 12 and February 14. The lowest temperature was -10° on December 18. The rainfall was below the average for every month except March, May and November. Extremely cold weather for the season occurred in late April when peach, pear and plum trees were in bloom and apple trees in bud. Much damage was done to fruit in this freeze. The winter was very mild. The mild weather of November and December, 1918, continued through the winter and ponds did not freeze thick enough so that the usual supply of ice could be harvested.

TEMPERATURE FOR 1919.

The mean temperature was 50.28°. This was 2.9° below the 31 year mean. January was warmer than usual with -4° for its coldest day. The mean was 4.09° above the average. February was somewhat colder but with no zero weather. The mean was 4.38° above normal. March continued mild with a mean of 3.26° above the average. April was nearly normal. The last killing frost and freeze was on the 25th to 27th with a low temperature of 24°. This was extremely cold weather for the season. The mean for May was 4.52° above normal. The hottest day was on the 29th with a temperature of 90°. 84° was recorded on the 5th. The highest temperature in June was 95°. The mean for the month was 6.57° above normal. The first week of July was especially hot with a temperature of 96° on the 6th. The monthly mean was 3.75° above normal. August temperatures were nearly normal. The highest was 95° on the 5th. There were no frosts in September. The highest temperature was 88° and the lowest 37°. The first frost was on October 9 with a temperature of 32° followed by 31° on the 12th and 13th. November weather was mild. The lowest temperature was 18°. The mean was 3.25° above the average. The month of December was cold with a minimum temperature of -10° on the 18th. The mean was 3.84° less than the average.

RAINFALL.

The rainfall for the year was 40.56 inches which was 3.24 inches less than the 31 year mean. January was a snowless and rainless month except for the 2.4 inches that fell on the 2nd and 3rd. Fair weather prevailed. There were only four stormy days in February. The rainfall was 1.15 inches below the average. March had a precipitation of 1.69 inches above normal. Cloudy weather prevailed. April had many light rains and cloudy weather. The rainfall was nearly normal. The greatest day's precipitation in May was 4.1 inches on the 12th. This was almost equal to the greatest rainfall in 31 years, that of 4.26 inches on June 21, 1903. The excess rainfall for the month was 1.93 inches. June was clear with no rainfall until the last week. July had no heavy rains but the showers were well distributed and the rainfall nearly normal. There was much cloudy weather. August was 1.43 inches below normal. Clear weather prevailed. September had many small rains which amounted to about the average. Cloudy and rainy weather predominated during October. The mean was nearly normal. The November rainfall was 1.40 inches above normal. December was deficient by 1.52 inches. There were many slight snow falls.

THE GROWING SEASON.

The growing season was of nearly average length. It began after the hard freeze preceeding April 27 and lasted till October 9. A period of 165 days. The warm weather of May and June were favorable for planting and early crop growth while the late frost allowed full maturity.

METEOROLOGICAL OBSERVATIONS FOR 1919

Temperature and Rainfall	January	February	March	April	May	June	July	August	September	October	November	December	Total	Average
Highest	56	50	63	70	90	95	96	95	88	86	74	60		
Lowest	—4	10	14	14	34	41	50	46	37	31	18	—10		
Mean	30.1	29.2	37.6	46.2	60.8	71.0	72.6	68.0	63.5	55.5	42.5	26.3		50.28
Total precipitation, inches.	2.40	2.49	5.74	2.78	5.30	2.07	3.61	2.46	3.66	3.00	4.78	2.27	40.56	
No. days with .01 inch or more precipitation	2	4	7	13	5	3	11	7	11	15	8	12		

Growing season Apr. 27 to Oct. 9. 165 days.

MONTHLY MEAN TEMPERATURE FOR PAST [illegible] YEARS

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Mean
1892	25.5	26.9	29.9	44.9	53.6	67.0	69.2	67.4	59.1	48.5	37.6	25.5	46.3
1893	17.3	23.5	30.3	42.0	54.5	64.2	67.9	68.0	55.9	51.7	38.1	27.8	45.1
1894	27.7	23.0	38.6	44.7	56.4	66.0	70.9	65.8	63.0	50.6	34.1	28.2	47.4
1895	24.4	19.9	31.1	44.1	57.5	66.6	66.1	68.3	63.1	45.0	41.7	32.6	46.7
1896	21.8	26.3	28.5	47.5	59.9	63.2	69.6	68.5	59.9	47.2	43.5	26.8	46.9
1897	25.0	27.0	34.0	46.0	56.0	62.0	69.0	66.0	60.0	51.0	39.0	31.0	47.2
1898	25.0	28.0	40.0	42.0	54.0	64.0	70.0	69.0	63.0	52.0	38.0	29.0	47.8
1899	25.0	22.0	31.0	45.0	56.0	67.0	68.0	67.0	59.0	52.0	39.0	31.0	46.8
1900	27.0	26.0	30.0	46.0	55.0	71.0	71.0	69.0	64.0	54.0	41.0	29.0	48.2
1901	25.0	19.0	33.0	45.0	54.0	67.0	71.0	66.0	62.0	50.0	33.0	29.0	46.2
1902	24.0	25.0	41.0	46.0	55.0	64.0	66.0	66.0	59.0	48.0	44.0	23.0	46.8
1903	26.0	27.8	43.1	45.9	58.8	59.3	68.0	61.7	60.8	51.1	35.8	23.3	46.8
1904	18.0	18.6	34.1	42.9	59.7	63.4	68.7	65.9	59.9	48.1	35.6	22.4	44.8
1905	20.5	19.3	34.1	44.8	57.0	64.0	71.5	66.0	59.7	53.6	38.0	32.5	46.8
1906	31.9	26.9	28.9	45.9	56.7	65.3	69.8	70.5	63.6	52.2	39.6	26.4	48.1
1907	25.4	19.0	35.8	41.4	50.7	62.0	71.6	65.9	61.9	49.4	40.2	33.8	46.43
1908	27.8	24.8	33.9	47.3	59.2	66.7	71.6	66.6	63.4	54.9	37.0	30.3	48.6
1909	28.6	31.1	32.8	46.6	55.7	66.4	67.4	67.5	60.4	50.2	44.5	26.6	48.15
1910	27.8	27.5	43.5	53.7	56.8	63.3	71.7	66.4	61.9	53.8	38.0	24.1	49.05
1911	29.6	25.4	33.0	44.5	61.8	64.5	73.1	67.9	64.1	49.7	38.0	34.8	48.65
1912	17.6	24.5	33.5	46.0	57.9	64.1	70.6	69.3	61.0	53.0	44.9	35.3	48.14
1913	36.5	25.6	42.0	48.1	54.4	64.7	70.8	68.6	60.3	57.0	44.2	36.4	50.71
1914	26.5	20.7	33.4	44.4	59.5	64.3	66.8	68.7	62.2	55.8	39.6	25.9	47.31
1915	29.8	30.1	33.3	50.7	54.9	66.7	69.8	66.0	65.0	52.9	41.9	28.7	49.15
1916	31.2	21.8	26.2	44.7	56.2	60.7	73.0	70.2	52.1	53.6	39.1	28.8	47.30
1917	26.5	23.5	34.5	43	49	64.5	70.5	72	56	47.5	33.50	21	45.12
1918	18	27.5	37.3	46.9	61.1	62.9	5.45	69.9	58.6	54.1	41.4	35.5	47.31
1919	30.1	29.2	37.6	46.2	60.8	71.0	72.6	68.0	63.5	55.5	42.5	26.3	50.28
*Mean	26.16	24.96	34.48	45.57	56.43	64.63	68.99	67.45	61.01	50.87	39.35	30.02	47.36

*The mean temperature includes data for 32 years.

TOTAL MONTHLY PRECIPITATION FOR PAST 28 YEARS.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Precip- itation
1892	4.91	1.60	3.00	0.70	5.60	2.77	3.25	5.20	1.40	1.09	5.41	1.35	36.28
1893	2.39	5.88	4.67	3.82	7.12	1.98	1.58	3.79	2.58	6.71	2.45	3.68	46.65
1894	2.24	3.13	1.18	2.67	3.58	0.59	2.09	2.37	3.01	4.16	4.00	4.31	33.33
1895	4.78	.63	2.62	4.27	2.16	1.78	4.13	3.48	2.97	6.74	6.97	4.12	44.65
1896	1.60	7.10	4.86	0.80	2.72	1.78	3.22	2.71	7.03	3.60	2.29	2.67	40.38
1897	3.84	2.70	3.66	2.37	4.44	2.79	12.24	5.23	1.39	0.92	7.14	5.61	52.33
1898	4.70	4.03	3.09	4.44	3.81	2.48	6.24	5.87	2.22	6.18	6.11	1.96	51.13
1899	3.76	3.97	5.58	2.20	1.17	3.72	5.55	3.27	3.31	1.54	2.10	2.14	38.31
1900	3.42	7.31	6.43	2.67	4.91	4.32	2.76	2.03	2.27	3.21	7.03	2.22	48.58
1901	8.50	1.05	7.18	9.51	6.30	1.96	5.54	7.58	4.33	1.97	3.04	9.55	66.51
1902	2.53	5.11	6.35	3.88	1.73	3.25	7.48	2.16	7.05	5.68	1.11	6.30	52.63
1903	3.73	5.18	7.09	2.81	0.50	9.24	4.56	4.52	1.81	2.79	1.95	4.27	48.45
1904	4.55	2.80	3.31	6.40	1.96	2.53	1.85	6.00	4.71	2.19	1.47	2.42	40.19
1905	3.57	1.21	3.45	2.87	0.90	4.53	1.77	2.63	5.79	2.57	2.73	4.12	36.14
1906	3.16	2.68	5.46	4.40	5.87	2.18	5.03	2.16	2.65	4.85	2.39	2.80	43.63
1907	3.13	0.37	1.68	2.40	3.16	2.81	1.43	1.09	9.61	4.97	6.42	5.28	42.35
1908	3.26	5.70	3.51	1.56	6.57	2.42	5.37	5.91	1.45	1.84	0.80	3.69	42.08
1909	2.77	6.95	3.99	4.38	3.89	2.02	0.84	2.01	5.32	1.58	1.73	3.82	39.30
1910	5.73	3.93	1.31	3.20	1.50	4.88	2.24	1.99	4.66	1.42	3.51	2.39	36.76
1911	2.34	2.73	3.56	2.98	0.33	1.20	3.46	5.50	2.94	6.24	4.92	3.53	39.73
1912	1.43	2.10	7.29	3.61	4.38	0.29	3.62	5.49	2.33	1.97	3.81	5.20	41.52
1913	3.95	3.00	5.86	4.80	3.35	2.32	4.25	3.55	2.60	5.72	2.05	4.13	45.58
1914	2.90	3.67	4.69	4.27	2.40	1.53	3.79	1.48	0.45	3.28	3.02	3.33	34.81
1915	7.52	4.41	0.15	1.18	2.64	0.93	8.28	5.92	1.51	2.71	2.93	2.49	40.67
1916	1.46	5.98	1.92	1.93	4.43	4.48	10.85	0.93	2.49	2.33	3.30	2.60	42.70
1917	2.86	3.29	4.84	1.87	3.00	4.05	2.65	7.06	1.13	6.12	0.47	2.83	40.17
1918	3.71	2.32	2.37	3.08	2.74	4.29	3.01	3.87	7.77	0.93	0.91	3.53	38.53
1919	2.40	2.49	5.74	2.78	5.30	2.07	3.61	2.46	3.66	3.00	4.78	2.27	40.56
*Mean	3.75	3.60	4.10	3.29	3.43	2.79	4.43	3.84	3.81	3.67	3.42	3.74	43.69

*The mean precipitation includes data for 32 years.

TABLE VI.

	Last Killing Frost, Spring	First Killing Frost, Fall	Length of Season in Days	Longest and Shortest Periods
1888	May 16	September 29	136	
1889	May 2	October 3	154	
1890	April 29	September 25	149	
1891	May 7	October 12	158	
1892	April 29	October 2	156	
1893	April 28	October 17	172	
1894	April 30	October 16	169	
1895	May 22	October 9	140	
1896	May 2	October 9	160	
1897	April 27	September 28	154	
1898	May 10	October 17	160	
1899	May 4	October 1	150	
1900	May 11	October 17	159	
1901	April 18	October 19	184	
1902	May 29	October 10	134	
1903	May 3	October 25	175	
1904	April 24	September 22	151	
1905	April 23	September 27	157	
1906	May 10	October 8	151	
1907	May 24	October 2	131	Shortest
1908	April 22	October 13	174	
1909	April 30	October 13	166	
1910	April 17	October 13	179	
1911	May 6	October 8	155	
1912	April 21	October 15	177	
1913	May 3	October 31	181	
1914	April 16	September 29	166	
1915	April 22	October 11	172	
1916	April 11	October 18	190	Longest
1917	May 16	October 12	149	
1918	April 25	October 19	177	
1919	April 27	October 9	165	
Average	May 1	October 10	160	

GRAND SUMMARY FOR 32 YEARS AT STORRS.

Temperature		Date
Range of annual mean	5.91°	
Mean	47.33	
Highest	99°	July 3, 1912
Lowest	-17°	Feb. 14, '14 and Dec. 30, '17
Highest annual mean	50.71°	1913
Lowest annual mean	44.8°	1914
Greatest range	116°	
Greatest daily range	50°	Oct. 29, 1919

Rainfall		
Mean	44.17 in.	
Greatest annual	66.51 "	1901
Least annual	33.33 "	1894
Greatest monthly	12.24 "	July, 1897
Least monthly	.15 "	March, 1915
Greatest daily	4.26 "	June 21, 1903

Growing Season		
Longest duration of	190 days	Apr. 11 to Oct. 18, 1916
Shortest duration of	131 "	May 24 to Oct. 2, 1907
Average date of last killing frost in spring		May 1
Average date of first killing frost in autumn		Oct. 10.

PREVAILING WIND.

January, February, March, April, May, August. October, November, December, N. W.; June, July, September, S. W.; for the year, N. W.

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State of Connecticut

PUBLIC DOCUMENT No. 32

TWENTY-THIRD REPORT

OF THE

DAIRY AND FOOD COMMISSIONER

TO

THE GOVERNOR

FOR THE

Fiscal Period beginning October 1, 1918,
and ending June 30, 1920.

PRINTED IN COMPLIANCE WITH STATUTE

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Dairy and Food Commissioner's Office
State Capitol, Hartford, Conn.

To His Excellency, EVERETT J. LAKE,
Governor of Connecticut:

Sir: In accordance with the provisions of the General Statutes, I herewith have the honor to submit my report for this department for the fiscal period beginning October 1, 1918, and ending June 30, 1920.

Thomas Hoer

Dairy and Food Commissioner.

THE DAIRY SITUATION.

Dairying is still the most important agricultural industry in Connecticut. It has been estimated that therein represents about sixty per centum of all agricultural activities in this State. From an economic standpoint there is no way in which the forage grown upon our farms can be so well utilized as through the dairy cow. She will work over crude fodders and grain into the greatest of all human foods, milk, and furnish four times as much digestible food nutriments as can be produced by steers or other meat animals from the same amount of raw material. It therefore behooves us to foster the dairy industry in every legitimate way.

Educational campaigns have been carried on to some extent country-wide to acquaint the people with the food value of milk, which have had a very good effect, but much remains to be accomplished in that respect. Our own Experiment Station at New Haven has been experimenting for more than twenty years on the food values of milk, and has just issued Bulletin No. 215 which gives the results of its findings. This bulletin may be obtained by applying to the Connecticut Agricultural Experiment Station, New Haven, Connecticut, and concludes with the following summary:

> "Milk is absolutely essential for the life of infants and very young chilldren.
>
> "It is a most desirable adjunct to the diet of older, rapidly-growing children.

"It is the main dietary reliance in cases of disordered digestion or extreme illness.

"Milk contains an abundance of protein, fat, carbohydrate and mineral nutriments, and its proteins are not only of superior value when used alone, but they are especially adapted to supplement the protein deficiencies of the cereals which form so large a part of the daily ration of mankind. Its mineral nutriments also supplement the deficiencies of the cereals, meat, sugar and fats in these important elements. Moreover, it contains the three vitamines without which life cannot be maintained.

"The scurvy-preventing vitamine is destroyed by heat and therefore if infants are fed on pasteurized or sterilized milk the use of orange juice or some vegetable extract is necessary to avoid the possibility of scurvy.

"Whole milk contains enough water-soluable vitamine to meet an infant's requirements, but if "the top of the bottle" diluted with water is fed, the supply of this essential vitamine may be insufficient unless it is supplemented from some other source.

"Milk is the only food known which is capable of serving as the sole constituent of an adequate ration.

"Milk is a cheaper form of food at 16 cents a quart than either beef at 35 cents a pound or eggs at 35 cents a dozen."

(Conn. Agri. Exp. Sta. Bul. No. 215, page 30).

It has been stated quite frequently that the cow is the foster mother of the human race, and it is also claimed that dairy products comprise one-fifth of the total food nutriments consumed by the people of the world. If these are facts it surely is important that dairy products should be produced from healthy animals kept in well-lighted, well-ventilated and clean stables, attended by clean attendants, and that a suitable milk room be provided for the cooling, storage and handling of milk.

INSPECTION OF DAIRIES

During the fiscal period covered by this report there have been 19,367 stable and milk distributing plant inspections made, and as a result of these inspections 5,116 letters were sent out ordering improvements in the methods of conducting the business of producing and distributing milk, and where orders were given with a time limit for making such improvements, reinspections were made at the end of that period to determine if orders had been complied with. One thousand and thirty-two such reinspections have been made, and the results obtained amply justify this method in milk control work. In accordance with Section 2490 of Chapter 128, General Statutes of Connecticut, Revision of 1918, it has been necessary to issue forty-two orders of prohibition against the sale of dairy products, because of insanitary conditions that might be detrimental to the public health.

The score cards, adopted in April, 1918, for the inspection of dairies and milk distributing plants, are of inestimable value as a means of determining the exact conditions found by inspection. They also aid the owner in determining just where his plant and methods are deficient, and point the way toward reaching a higher score.

There has been a very satisfactory improvement in the average score of the dairies of the State during this fiscal period amounting to 10.09 per centum, which is very gratifying, especially when we consider that we have been passing through a period of extreme labor shortage on the farms.

THE COOLING OF MILK.

Second only to cleanliness in importance in the care of milk is prompt cooling to at least fifty degrees F., and where cold well or spring water is available in abundance much ice can be saved by pre-cooling with water, then changing the water before putting ice into the cooling tank.

If well water is used it will be necessary, however, to establish a pumping system that will pump water from the well into the bottom of the tank, and to have an overflow outlet so that the warm water may overflow as the cold water is pumped in.

The use of wells for placing cans of milk in is prohibited, as we find it is a very dangerous practice. The spilling of milk may contaminate the water, and in turn the contaminated water may gain access to the cans, or contamination may be carried by the use of this water for washing dairy utensils. A special letter in this regard was issued from this office on October 1, 1919.

In large dairies it is probably necessary to use some one of various kinds of metal coolers, which accomplishes results very quickly, but in the small dairies we find that better results are obtained where the cooling is accomplished in the delivery can providing the milk is stirred several times during the first hour of cooling. A metal stirrer which may be also procured from dairy supply houses is recommended. It is equally necessary to have the water surrounding the cans agitated, which may be accomplished with a wooden paddle.

Considerable difficulty is encountered in having Section 12 of the Rules and Regulations of the Milk Regulation Board complied with, which reads, "Milk shall be cooled to fifty degrees F. within two hours after milking." The extreme shortage of labor has perhaps been more severe on the farms than elsewhere, and while we have refrained from prohibiting the sale of milk, even at a temperature somewhat higher, we still believe that the requirement of fifty degrees F. is very reasonable and desirable, and now that the labor situation has been relieved, we shall expect a compliance with the requirement of fifty degrees F.

It has long been the practice in many sections of the State to have empty milk cans left by the roadside unprotected, and in turn cans of milk would be left until trucks came along to take them up; sometimes hours intervening before the milk is loaded for market. This allowed the temperature to rise, and dust to collect on the cans, which was very insanitary. A special letter was issued in regard to this matter to the producers living in such territories as followed this practice, and they were advised to provide suitable shelter so that the milk would not deteriorate before reaching the market. There is great need of closer co-operation between the producer and collector of milk in regard to the time of collection, and we have detailed inspectors the past summer to look into this matter, take temperatures, and see that the milk on the trucks is properly protected. We found it necessary in some cases to prohibit the milk from going to market where the temperature was over sixty degrees, but this action was taken only after repeated warnings.

THE PASTEURIZATION OF MILK.

The term "pasteurization" carries with it an assumption of safety from the germs of diphtheria, typhoid, tuberculosis, scarlet fever, septic sore throat, and other diseases, and when properly carried out according to certain standards this assumption is surely justifiable. In March the Milk Regulation Board (which was created by act of Legislature of 1917), after a public hearing, as provided by Section 2486 of Chapter 128, General Statutes of Connecticut, Revision of 1918, adopted rules and regulations for the pasteurization of milk, which we believe, when fully complied with, will safeguard the public health to the greatest possible extent. While this will entail an additional expense to this department, we believe it to be absolutely necessary in view of the fact that approximately forty per centum of the milk sold in the State is sold as "pasteurized."

ERADICATION OF TUBERCULOSIS.

It has been estimated that thirty per centum of the milking cows in the State are tubercular. There is a growing desire on the part of dairymen to have their herds tested for tuberculosis under the rules and regulations of the Commissioner on Domestic Animals, and I trust that the General Assembly will make a generous appropriation for the eradication of bovine tuberculosis. Considerable progress has already been made, but the appropriations have been entirely inadequate for this important work of safeguarding the public health.

PUBLICATIONS.

The winter of 1918-1919 was so mild that very little Connecticut ice was harvested, and it was extremely difficult to take care of milk in the summer of 1919. This office, in conneciton with the Connecticut Agricultural College Extension Service, issued a bulletin entitled "Meeting the Ice Shortage on the Farm," which was sent to all farmers producing milk, instructing them as to the best methods to be employed in cooling milk in the absence of ice.

In October of the same year a special letter regarding the necessity of storing ice was sent out, and this advice was very generally followed.

Immediately after the adoption of the first rules and regulations for the production, care, and distribution of milk in October, 1917, by the Milk Regulation Board, Bulletin No. 7 was issued, which contains a copy of the law creating the Board and the general rules and regulations adopted for the production, care, and distribution of milk, with several pages devoted to suggestions as to some of the most important features attending the production and distribution of milk and cream.

In March of the present year rules and regulations for the pasteurization of milk were adopted and they have been made a part of Bulletin No. 7.

In January, 1920, Bulletin No. 8, entitled "Ventilation of Dairy Stables," was issued, which we believe is a most important subject pertaining to the health of dairy animals kept in confinement. Wherever disease has gotten a foothold it spreads very rapidly in poorly-ventilated stables, and animals cannot do good work and produce a suitable food product unless supplied with plenty of fresh air. This bulletin is available and will be mailed upon request.

It does not seem likely that Connecticut will ever be able to produce economically the grains necessary to feed the cows that can be kept within her borders, but there is practically no limit to the amount of hay, corn silage, and other forage crops that may be raised here, and if proper rotation of crops is followed with alfalfa clovers and other legumes in rotation, there would be no necessity for importing hay from other States, with the almost prohibitive freight rates in existence at the present time.

We find upon careful investigation that an estimated number of 100,000 cows in the State are producing annually $23,000,000 worth of milk at the farms, which costs the consumer approximately $40,000,000 annually. We are shipping to Massachusetts, Rhode Island and New York milk to the extent of $2,004,000, and the states of New York and Vermont are shipping into this State approximately $500,000 worth of milk and cream annually. This shows that we are exporting four times as much milk and cream as we are importing.

CREAMERIES.

The volume of yearly business of the creameries of this State continues to decline. The milk dealers of the cities have encroached upon the territory from which the creameries draw their supplies to such a large extent that it is extremely difficult for them to obtain cream in sufficient quantity to make the manufacture of butter profitable, and it would seem that the time is not far distant when the creameries may be a thing of the past in Connecticut, a condition which is deplorable, to say the least. A list of the creameries and information incident thereto may be found on page 18.

FOOD CONTROL

MILK

Two thousand, one hundred and seventy-nine samples of milk were procured by our inspectors. Four hundred and twenty-nine of these proved to be below standard, 107 hearings were held and 13 of these violators were prosecuted, 43 samples were found to be slightly below standard, and letters of warning were sent in these cases. One hundred and seventy-four samples proved to be watered, 81 hearings held and 67 court convictions were secured, in most instances representing two or more samples. This explains the difference between the number of samples taken and the number of convictions. Twenty-seven samples were found skimmed, 26 hearings held, and 12 prosecutions were made.

One hundred and eighty-six samples were taken for bacteria only, and in five cases bacteria were found far in excess of one million bacteria per c.c., which, according to Section 2482 of Chapter 128, General Statutes of Connecticut, Revision of 1918, is considered impure milk.

Seven samples of top milk were secured, and letters were sent to show that this would cause some one to receive skimmed milk. Top milk is possible by milk being insufficiently mixed, either at the place of bottling or at the place of sale by filling glasses from bottles, the first glass carrying more or less than its share of butter fat. This practice, either through ignorance or carelessness, is very unfair to the one being deprived of the proper proportion of cream.

The average percentage of butter fat in milk has steadily declined for the last twenty-five years. As a result of payment being made to producers by the quart regardless of the fat or solids content, cows of large production have been raised to take the place of the Channel Island breeds, so that instead of milk carrying an average of 4.5 per centum butter fat we now have an average of about 3.6 per centum, with other solids correspondingly low. The State standard is 3.25 per centum butter fat, 8.50 per centum solids-not-fat.

There is a feeling on the part of the public, because of this lower amount of fat and solids-not-fat, that skimming is largely practiced. This, however, is erroneous in view of the fact that out of 2,179 samples taken only 27, or one and one-quarter per centum, proved to be skimmed, while 174, or nine per centum of the samples, were watered.

OLEOMARGARINE

In my last report I recommended that a bill should be presented to the General Assembly increasing the license fees for manufacturing, selling, or using oleomargarine or renovated butter, as follows:

> For making oleomargarine, butterine or renovated butter, from twenty-five to fifty dollars;
>
> For selling oleomargarine, butterine or renovated butter in quantities of more than ten pounds, from five to twenty-five dollars;
>
> For selling oleomargarine, butterine or renovated butter in quantities of not more than ten pounds, from two to ten dollars;
>
> For the use of oleomargarine, butterine or renovated butter by a bakery, hotel, restaurant, or dining room, from one to five dollars.

This bill was presented but unfavorably reported by the Committee on Public Health and Safety, as it was thought it might increase the cost to consumers, which I think was erroneous in view of the fact that Pennsylvania has a license law many times higher than ours, and a survey shows that prices in New Jersey, a bordering state with no license, were as high as in Pennsylvania, and the quality did not average as good on account of inefficient control work. I quote from my last report that

> "Oleomargarine is an imitation product susceptible to fraud and deception, and it should be under close supervision. The license fee should be adequate to cover all expense incident thereto. A higher license would also be treated with more respect, as we find that not only the licensee but Court officials feel that it is only a matter of small concern where there is such a small license fee charged."

There has been a total of 8,073 inspections of places selling or using oleomargarine; 1,013 violations were found, of which 520 cases were presented to prosecutors. The reason for such a difference between violations and prosecutions is largely on account of persons just entering into business with no knowledge of the law's requirements, and a license was issued to these after giving them warning against a repetition of the offense.

I would recommend that the oleomargarine license expiration date be changed to June 30th instead of September 30th, as it now is, so that it may be concurrent with the Federal requirement.

During the license year, October 1, 1918, to September 30, 1919, 2,210 retail, 140 users and 52 wholesale licenses were issued; and from October 1, 1919, to June 30, 1920, 2,081 retail, 85 users and 43 wholesale licenses were issued. There has been collected and paid into the State Treasury for these licenses $7,901.91.

COLD STORAGE EGGS.

There have been 9,980 store inspections with especial reference to cold storage eggs, and 4,090 of such stores were found violating Sec. 2461 of Chapter 128, General Statutes of Connecticut, Revision of 1918. In 600 of these cases the violations were so flagrant that they were presented to the prosecutors of their respective towns.

There was an attempt made in the last Legislative Session to repeal Sec. 2463 of Chapter 128, General Statutes of Connecticut, Revision of 1918, which is very difficult of enforcement, but it was not repealed.

In the absence of a general cold storage law, such as is in effect in many other states, we find it very difficult to enforce the egg law on account of not being able to prove that eggs have been in cold storage fifteen days. I would recommend a change in the statutes which would simplify the method of determining whether eggs have been held in cold storage fifteen days.

ICE CREAM.

The General Assembly of 1919 enacted an ice cream law, and one of its provisions declares that ice cream shall contain not less than eight per centum milk fat; nut or fruit ice cream shall contain not less than six per centum milk fat. Ice cream, however, may be sold with a lower fat content if it is made known to purchasers by a suitable sign giving the true fat content.

For the convenience of manufacturers and vendors of ice cream, hearings were held in Hartford, New Haven, Bridgeport and Waterbury to fully explain the provisions of the new law. During the period August 1st to December 1st, 1919, 768 samples were taken, and while those taken prior to the hearings showed fifty per centum violations, practically all samples taken subsequent to the hearings complied with the statutes.

Sampling was resumed during the past summer and to June 30th (the end of this fiscal period) 85 samples were purchased with only three in violation. These were presented for prosecution. I believe there is cause for gratification in these results, showing that ice cream makers are willing to live up to statutory requirements when properly instructed. Copies of the law may be had by applying to the Dairy and Food Department.

SOFT DRINKS.

With the passage of the prohibition amendment to the Federal Constitution, there has been a tremendous increase in the sale of so-called soft drinks. Plants large and small (mostly the latter) have sprung up (as if by magic) over night, and most of the owners entirely unfitted, by experience or equipment, for the purpose of preparing drink for human consumption.

I consider the present condition in bottling establishments a menace to the public health, and before another summer some existing State department should be given ample power to effectively control the operations of bottling establishments.

One hundred and eighty-eight inspections were made of soft drink establishments, and 140 reinspections; 266 samples were taken and analysis showed that 73 contained saccharin. Speaking before the National Bottlers' Association at their annual convention in Cincinnati in November of this year, Dr. Carl L. Alsberg, chief of the Bureau of Chemistry, Washington, D. C., had the following to say about saccharin:

> "Especially do I wish to express my appreciation of the action taken by your association in regard to the use of saccharin, and the definite, and I expect in some quarters, unpopular, stand taken by your executive committee. During the recent sugar shortage, I appreciate fully the great temptation it was from a business standpoint to resort to the use of saccharin, and I listened with a great deal of interest to the numerous statements made to me about the matter, but it is a great satisfaction to me to realize how few of your trade actually have debased their goods by substituting saccharin for sugar. We believe the evidence is conclusive that saccharin is a harmful substance, and has no place in our foods."

The use of saccharin in normal foods is absolutely prohibited under Connecticut regulations. Those guilty of a first offense were given a warning, but in the case of second offenses their cases have been presented to prosecuting officers.

In the Spring of 1920 the Bureau of Chemistry, Washington, D. C., made a ruling to become effective January 1, 1921, that where capsicum was used in ginger ale its presence must be declared on the label. Of the samples taken by this department 38 were found to contain capsicum. It is the intention of this department to enforce this ruling.

PRESCRIPTIONS.

The State Pharmacy Commission requested our department to procure prescriptions at five places. Three of these were found to be adulterated, one of which was so much below the required strength that the druggist was prosecuted and convicted in the Hartford Police Court, and his license revoked by the State Pharmacy Commission.

DRUGS.

In consultation with Dr. E. Monroe Bailey, chief chemist at the Connecticut Agricultural Experiment Station, a decision was reached as to the drug samples necessary for this department to secure. List in detail is as follows:

SUMMARY OF SAMPLES TAKEN

Drugs

Name	No. of Samples	Adulterations	Hearings	Prosecutions	Warned by letter
Antiseptics	3	..	..	..	..
Aspirin Tablets, 5 gr.	23	1	..	..	1
Citrate of Magnesia	10	1	1	..	..
Cough Remedies	5	..	..	..	..
Hydrogen Peroxide	20	..	..	..	..
Lime Water	28	7	7	..	..
Prescriptions	5	3	3	1	..
Spirits of Camphor	19	8	8	..	..
Tincture Cinchona	7	3	3	..	..
Tincture Cinchona Comp.	24	9	9	..	..
Tincture Iodine	17	4	2	..	..
Tincture Iron	12	1	1	..	..
Tincture Nux Vomica	19	10	8	..	..
Tonics	14	..	..	..	..
Whiskey	6	6	..	..	..
Witch Hazel	24	1	1	..	..

Barber Supplies

Name	No. of Samples	Adulterations	Hearings	Prosecutions	Warned by letter
Bay Rum	3	..	..	..	..
Dandruff Remedies	4	..	..	..	..
Hair Dyes	3	3	..	..	..
Hair Tonics	56	12	7	..	5
Shaving Lotions	4	1	..	..	1
Shampoo Compounds	14	6	6	..	..

Toilet Preparations

Name	No. of Samples	Adulterations	Hearings	Prosecutions	Warned by letter
Creams and Lotions	26	4	..	..	4
Toilet Waters	13	..	..	..	..
Tooth Washes	8	5	..	..	5

Foods

Name	No. of Samples	Adulterations	Hearings	Prosecutions	Warned by letter
Coffee	2	..	..	..	..
Chocolate and Cocoa	3	..	..	..	..
Flours	4	1	1	..	..
Honey	1	..	..	..	..
Macaroni	1	..	..	..	..
Olive Oil	5	3	3	3	..
Powdered Milk	2	..	..	..	..
Stock Feeds	4	1	..	..	1
Sugar and Syrups	4	1	..	..	1
Vinegar	14	6	..	..	6

I wish to express my gratitude to the Health Officials and Milk Inspectors of the different cities and towns of the State for the valuable aid they have rendered the department in sampling milk in their several localities and forwarding same to the laboratory of the State Department of Health for analysis. The results of such anaylses have served as a guide to inform this department of the quality of milk dispensed in their respective territories (this office being supplied promptly with a copy of the analysis of every sample of milk taken in the State, thereby being enabled to know just where violations are occurring).

The thanks of the department is hereby tendered to the director of the Connecticut Agricultural Experiment Station, Dr. E. H. Jenkins, and to its Chief Chemist, Dr. E. M. Bailey, also to its staff of workers. The splendid service they have rendered this department is worthy of all praise. We have been compelled to overburden them very severely at times, but they have taken it good-naturedly, even though it has compelled them to work overtime many times in order to analyze samples before they might spoil. As in other lines of work, they have been handicapped by a shortage of chemists and inadequate funds for the ever-increasing work of their department.

I also wish to commend the work of the director and staff of the Laboratory of the State Department of Health. They have ever been willing to give us assistance in analytical work whenever called upon.

The regular working force of the Dairy and Food Commissioner's Department consists of the Commissioner, the Deputy Commissioner, two stenographer-clerks, eight dairy and food inspectors, and one woman food inspector for stores, as follows:

Thomas Holt, Dairy and Food Commissioner, Newington
H. O. Daniels, Deputy Dairy and Food Commissioner, Middletown
Wilhelmina Hurst, Chief Clerk and Stenographer, Hartford
Ruth B. Sinclair, Clerk and Stenographer Hartford
William J. Warner, Dairy and Food Inspector, Gilead
George T. Fowler, Dairy and Food Inspector, No. Branford
James C. Gilbert, Dairy and Food Inspector, Newington
FitzHenry Paine, Dairy and Food Inspector, Abington

Ralph A. Ayer, Dairy and Food Inspector,	**Torrington**
Carroll, D. Blanchard, Dairy and Food Inspector,	**Newtown**
Fred H. Page, Dairy and Food Inspector,	**Durham**
R. A. Splettstoeszer, Dairy and Food Inspector,	**New Britain**
Mrs. Kate E. Stadmueller, Food Inspector,	**Elmwood**

EXPENSE ACCOUNT

Commissioner's salary	$4,000.00	
Office and traveling expenses		$7,067.67
Deputy Commissioners' salary	3,200.00	
Office and traveling expenses		2,163.25
W. J. Warner, services	2,926.50	
W. J. Warner, expenses		3,901.53
G. T. Fowler, services	2,194.50	
G. T. Fowler, expenses		2,042.30
W. F. Potter, services	1,236.00	
W. F. Potter, expenses		1,449.67
I. P. Campbell, services	120.00	
I. P. Campbell, expenses		94.08
J. C. Gilbert, services	890.00	
J. C. Gilbert, expenses		807.64
R. F. Kimberly, services	584.75	
R. F. Kimberly, expenses		917.58
F. H. Paine, services	2,662.50	
F. H. Paine, expenses		2,625.70
R. A. Ayer, services	2,273.00	
R. A. Ayer, expenses		2,861.25
Mrs. K. E. Stadmueller, services	2,279.50	
Mrs. K. E. Stadmueller, expenses		1,347.97
Mrs. B. G. Kearnes, services	419.60	
Mrs. B. G. Kearnes, expenses		681.85
A. Tilden, services	270.00	
A. Tilden, expenses		291.60
E. Hudson, services	35.00	
E. Hudson, expenses		85.10
M. J. LaMere, services	210.00	
M. J. LaMere, expenses		268.50
F. S. Chapman, services	190.00	
F. S. Chapman, expenses		172.91
C. D. Blanchard, services	249.00	
C. D. Blanchard, expenses		366.75
F. H. Page, services	697.00	
F. H. Page, expenses		713.45
R. A. Splettstoeszer, salary	185.00	
R. A. Splettstoeszer, expenses		217.75
	$24,622.35	$28,076.55

CREAMERIES

Name of Creamery	Location	President	Secretary	Superintendent	Butter Maker	Capital
*The Bryant & Chapman Co.	Hartford	W. M. Bryant	B. W. Chapman	W. S. Patrick	H. Patrick	$99,000
Canton Creamery Co.	Canton Center	C. R. Quick	B. Case	C. R. Quick	R. C. Bristol	2,675
**Danbury Creamery & Haviland Dairy	Danbury	H. A. W. Schneyer	....	....	H. A. W. Schneyer	10,000
Granby Co-op. Creamery	Granby	G. O. Beach	S. F. Holcomb	H. W. Fuller	H. W. Fuller	2,975
The Jewett City Creamery Co.	Jewett City	W. C. Terry	B. C. Bliss	B. C. Bliss	B. C. Bliss	4,000
Lebanon Creamery Co.	Lebanon	T. D. Blight	O. L. Pultz	O. L. Pultz	O. L. Pultz	3,400
*Litchfield Creamery	Litchfield	W. T. Marsh	W. G. Grannis	M. D. Beach	L. A. Dickinson	2,200
Ned's Brook Creamery Co.	Canton	James Case	J. M. Gladwin	J. M. Gladwin	J. M. Gladwin	1,125
*Scotland Dairy Co.	Scotland	G. C. Cary	L. B. Ashley	....	....	1,400
**Torrington Creamery	Torrington	....	....	....	....	....
**Tunxis Creamery	Colebrook	....	A. L. Lewis	A. L. Lewis	A. L. Lewis	2,500
The Vernon Creamery Co.	Rockville	G. N. Skinner	A. R. Lathrop	A. W. Annis	A. W. Annis	8,500
*Wapping Creamery Co.	Wapping	H. A. Slater	C. J. Dewey	C. J. Dewey	D. Johnson	3,500

*Incorporated
**Proprietary
All other co-operative

State of Connecticut

PUBLIC DOCUMENT NO. 38

Sixth and Seventh Biennial Reports

OF THE

Commissioner on Domestic Animals

TO

HIS EXCELLENCY THE GOVERNOR

For the Two Years Ended September 30, 1918,

AND

For the one year and nine months ended June 30, 1920.

PRINTED IN COMPLIANCE WITH STATUTE

HARTFORD
Published by the State
1920

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THE BOARD OF CONTROL.

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WATERBURY, CONN.

State of Connecticut
OFFICE OF THE
COMMISSIONER ON DOMESTIC ANIMALS
CAPITOL, HARTFORD.

J. M. WHITTLESEY, Commissioner.
CHAS. L. COLTON, V. M. D., Deputy Commissioner.

To His Excellency, Marcus H. Holcomb, Governor,

Sir: In accordance with the provisions of Section 2086, General Statutes, I have the honor to present the Sixth and Seventh Biennial Reports covering the work of this Department for the fiscal years of 1917, 1918, 1919, and 1920.

Believing that this department is conducted for the protection of the public health as well as the livestock industry of the State, I early endeavored to establish a feeling of confidence and co-operation between this department and all needing its good offices.

The safeguarding of our animals from infection at home and through introduction of disease from without has been my most earnest effort, particularly bearing in mind the transmissibility from the animal to the human of such diseases as tuberculosis, anthrax, rabies and glanders.

It is gratifying to notice the constantly increasing friendly intercourse between this office and the farming industry throughout the State. Many reforms have been instituted; irregularities and hardships in the matter of importations have been corrected. Steps looking to the more effective prevention of the entrance of disease-bearing animals into our State have been taken with marked results.

It seems advisable to publish the report for the year 1917 and 1918 with this report of 1919 and 1920 for the reason that the legislators of 1917-1919 practically rewrote all the laws especially pertaining to this department, adding greatly to the duties and responsibilities of the commissioner and his deputy. These changes caused a complete reorganization of plan and management of this department, necessitating the employment of two special deputies, one veterinary inspector for his entire time, and two clerks to care for the material increase of the general office work, and the establishment of an efficient system of filing and recording more in keeping with the importance of the livestock industry.

Very respectfully submitted,

J. M. WHITTLESEY,
Commissioner.

December 1, 1920.

BOVINE TUBERCULOSIS.

The subject of basic importance to the farmer and dairyman is that of tuberculosis in the bovine, its control and eradication from the herd. The following extracts cover the previous efforts of this department to control bovine tuberculosis.

Quickly following the announcement by Prof. Koch in 1882 that tuberculosis could be positively diagnosed in cattle by means of his tuberculin test, arose the hope of eradicating from the cattle industry its worst scourge. Little realizing the necessity of the skilled operator in applying this most positive, delicate and scientific test, the idea of eradication was carried to all extremes, resulting in the slaughter of large numbers of cattle throughout the country, particularly in our own State. As the work increased with seeming little proportionate result in abatement of the disease, less and less confidence was felt in the ultimate accomplishment of eradication, until 1897, after two years of eradication work, state testing in Connecticut was abolished and the return to physical diagnosis only as protection against tuberculosis was made.

Taking from the records, it is interesting to note that in 1894 after canvassing the State, the Commissioners on Diseases of Domestic Animals experimentally tuberculin tested 149 bovines, condemning, killing and posting 31 for tuberculosis. The following year 2,092 head were examined for tuberculosis and of these 1817 were tested with result of 357 or 19.6% condemned. This stimulated the Commissioners to renewed efforts and, with the idea of eradication, 6,304 cows were tested with 897 reactors or 14.2%. The far reaching work here so well commenced was unfortunately interrupted by the legislating out of office of the three Commissioners on Diseases of Domestic Animals and the reversal of their policy regarding tuberculin testing. The succeeding Commissioner on Domestic Animals closed his first report for the year 1898 with these very significant words:

"A large number of animals were examined during the year and 71 condemned, all but four of which were tuberculous."

"This shows tuberculosis to be the most prevalent disease, still it does *not* prevail to any *alarming* degree and need cause no unnecessary alarm," and this at a time when there were 137,000 milch cows and 77,000 beef animals in the State.

Can you imagine the "large number of animals" examined by this Commissioner of 20 years ago to produce 67 tuberculous cows, condemned by physical examination alone as compared with the work of the preceding year of the three Commissioners on Diseases of Domestic Animals, with their 6,304 tuberculin tested animals giving 897 or 14.2% condemned and posted with the following results:

135 cases 15.4% lesions found in Retro-pharyngeal glands.

287 cases 32.7% lesions found in Mesenteric glands.
101 cases 11.5% lesions found in Portal glands.
533 cases 60.7% lesions found in Liver.
431 cases 49.0% lesions found in peritoneum.
26 cases 3.0% lesions found in Uterus.
688 cases 78.4% lesions found in Lung.
301 cases 34.3% lesions found in Bronchial glands.
501 cases 57.1% lesions found in Mediastinal glands.
60 cases 7.0% lesions found in Udder.
347 cases 38.4% lesions found in Pleura.

During the 16 years following the lulling of the cattle owners into false security by the above quoted misleading statements of the 1897 report (that is, from 1900 to 1916) 46,188 bovines were examined physically with the result of 6,406, about 13% plus, condemned.

Thus we see the increase during twenty-two years of a percentage of tuberculosis in cattle reacting to the test rising from 14.2% in 1896 with its 214,000 head of cattle to 26.9% in 1918 (as revealed by the State and Federal tests) with the lesser number of 153,264 head—a record of 22 years of breeding, herding, importing tuberculosis with only perfunctory efforts at control by the State and individual protection by isolated private tests until the 1911 law provided state assistance if asked for, and upon which the State Herd Test of 1919 was formulated.

No wonder Connecticut has been a laughing stock to outside cattle men—no wonder our State became the dumping ground where unscrupulous cattle dealers unloaded their tuberculous cattle.

The time for temporizing with tuberculin testing has passed. The crusade against tuberculous cattle has been finally launched. Urged by the cattle men on the one hand and the medical profession on the other, the U. S. Bureau of Animal Industry has set its wonderful organization in motion to do this work with the full knowledge not only of the $25,000,000.00 annual animal loss, but also of the Transmissibility of Bovine Tuberculosis to the human as instanced by such facts as those of Park and Krumwiede where, for instance, one group of 1,511 human tubercular post mortems revealed in

955 over 16 years of age—15 of the Bovine Type; 177 between 5 and 16 years—46 of Bovine Type; 368 under 5 years of age—76 of Bovine Type; while in 11 cases, both Bovine Type and Human Type were found. Further, Mitchell of Edinburgh examined 72 cases of cervical gland tuberculosis in children, of which 90% showed the Bovine Type. In 261 cases, bone and joint disease Bovine Type was found in 21%, with 29% under 10 years of age.

Quoting from the State Board of Health:

"The use of milk from tuberculous cows constitutes a distinct menace to public health. The findings of able investigators show that a very large proportion of tuberculosis in young children is of the bovine type."

With the idea of improving testing and bringing it to a basis uniformly enforcible throughout New England, five of the Commissioners of the New England States held repeated meetings at which all phases of the subject were thoroughly discussed and agreement reached that official tuberculin tests should consist of three preliminary temperatures followed by six post temperatures after injection of the tuberculin, all subject to uniform rules as arranged by the Commissioners.

On the whole, as Connecticut was the most lax, it is now fully equal to the surrounding states. Notices were issued January 1st, 1918, and it is most pleasing to the Commissioner to notice the steady rise in the effectiveness of the test and the ready compliance with the requirements as soon as they were understood.

In passing it is gratifying to know that these "Commissioners Meetings," entirely informal, have been of the greatest importance in establishing the hearty cooperation now existing between all of the New England States whereby the livestock industry is being fostered and control of contagious diseases maintained to an extent never before attained.

As work progressed, there have been times when additional legislation seemed advisable whereby the Commissioner might deal more effectively with the matter of tuberculosis in cattle. To this end legislation was sought, with the result of passing Chapter 111, Public Acts, 1919, "An Act Concerning the Eradication of Tuberculosis in Herds of Bovine Animals and the Establishment of the 'Accredited State Herd Test'," under which the State Accredited Herd Test was established with most satisfactory results, later merged in the State and Federal Accredited Herd Test as now conducted since uniting with the Federal Government as provided in Section 2 of the above Act.

The test has proved unexpectedly popular as evidenced by the fact that from the passage of the Act to the close of the fiscal year 1920, 362 tests comprising 9,573 head were under supervision, while the waiting list shows 48 applications awaiting test on 892 head. Unfortunately these must remain untested until further appropriation shall be provided by the incoming legislature, as the funds apportioned for the work proved far too small to meet the overwhelming call for testing and remuneration, although every source of salvage was invoked to assist our meager appropriation.

Supervisions over the sale of tuberculin and disposal of reacting cattle when tested by private test was accomplished through the enactment of Chapter 169, Public Acts 1919, "An Act Concerning the sale of Tuberculin and Prohibiting the Sale of Cows Which Have Reacted to the Tuberculin Test," whereby the use of tuberculin is reported to the Commissioner with the identification of reacting cattle. This has been of great value and will in the future do more to eliminate the spread of tuberculosis than any other one act under which the work of control is conducted.

A step further in this direction would be the requiring of all cattle entering the State to be held in quarantine a suitable time and then re-tested by state veterinarian at the expense of the State.

RECORDS.

In reference to cattle physically examined for Bovine Tuberculosis as provided by Section 2096 of the General Statutes:

	1917	1918	1919	1920
No. of applications received	259	223	162	248
No. of cattle examined in response to applications	2205	918	516	1246
No. of cattle condemned..	279	169	132	204
Per cent. of cattle condemned	13%	18%	26%	16%

REMUNERATION FOR ANIMALS CONDEMNED BY PHYSICAL EXAMINATION.

Total amount paid owners by Comptroller	$5,370.63	$3,339.55	$2,620.43	$4,019.44
Total amount of salvage received by owners.....	205.20	685.24	966.44	1,601.46
Total amount of remuneration received by owners	5,575.83	4,024.79	3,586.87	5,620.90
Average amount per head paid by Comptroller...	20.42	19.76	19.85	19.70
Average amount per head received by owners....	21.20	23.81	27.17	27.55

STATE ACCREDITED HERD TESTS.

As provided by Section 2096, General Statutes, and Chapter 111, Public Acts 1919, the following tuberculin herd tests have been made under the supervision of the State:

	1917	1918	1919	1920
No. of herds.........	23	81	82	149
No. cattle tuberculin tested	654	1925	2712	3239
No. cattle condemned	181	520	514	541
No. cattle quarantined	no record	41	2	65
No. cattle passed for food	"	414	462	364
No. cattle tanked....	"	65	50	109
Amt. paid to owners by Comptroller....	$ 7,610.76	$16,069.23	$16,765.49	$21,348.81
Salvage paid to owners	7,294.24	17,026.14	18,948.52	11,208.48
Total amount paid to owners	14,905.00	33,095.37	35,714.01	32,557.29
Per cent. of reactors.	28%	27%	19%	17%

Under authority of Chapter 111, Public Acts 1919, this department has co-operated with the United States Department of Agriculture in its national plan now in operation in forty-four states, known as the "accredited herd plan in the eradication of tuberculosis." Dr. E. I. Smith has been appointed Inspector in Charge in Connecticut for the Bureau of Animal Industry, United States Department of Agriculture, and is assisted by two veterinary inspectors and one clerk. Therefore, in this co-operation the federal government contributes one-half the veterinary services and expenses, one-half of the clerical work, and one-third of the remuneration paid owners of cattle condemned by the State, to the limits of $25.00 for grades and $50.00 for purebreds.

The following tuberculin herd tests have been made under the supervision of the State in co-operation with the United States Department of Agriculture:

	1919	1920
Number of herds	7	182
Number cattle tuberculin tested	262	5754
Number cattle condemned	24	967
Number cattle quarantined	1	106
Number cattle passed for food	13	686
Number cattle tanked	9	197
Amount paid to owners by Comptroller	$905.17	$31,811.60
Amount paid to owners by Federal Government	441.17	15,448.53
Salvage paid to owners	563.66	22,678.63
Total amount paid to owners	1,910.00	69,938.76
Per cent. of reactors	9%	17%

In proof of the fact that tuberculosis can be eradicated from herds this work shows on June 30, 1920, although the law has been operative only one year and three months, 73 herds comprising 1,463 animals which have passed one test without reactors, and 19 herds comprising 486 animals which have passed two annual tests without reactors.

The following money was received in reimbursement for certain miscellaneous expenses and for salvage in excess of appraisal value of condemned cattle, and returned to the State Treasurer:

1917	1918	1919	1920
$12.00	$63.83	$20.26	$30.87

CATTLE IMPORTATIONS.

Fiscal Year	Total Number	Immediate Slaughter	Dairy and Breeding and Exhibition
1917	13,440	8,571	4,869
1918	13,774	9,913	3,861
1919	9,758	7,002	2,756
1920	15,360	11,591	3,769

	1917	1918	1919	1920
Number of cows reacting to test made after arrival and slaughtered	1	86	17	33

ANTHRAX.

This most deadly disease to both animal and man, heretofore occasionally reported effecting our cattle, again made its appearance in an entirely new area, fully twenty-five miles from the last outbreak, in the vicinity of Hartford.

Beginning with one outbreak in 1917 with a loss of ten head valued at approximately $1,000.00 on an area of two square miles, the record shows eleven different localities effected involving a loss of thirty-five head valued at $10,000.00 during the year 1918.

Realizing that unless strenuous efforts were made the State would shortly be infected in rapidly widening areas, the lack of legislation was overcome by the passage of Chapter 91, Public Acts 1919, "An Act Concerning the Control of Anthrax or Charbon." With the plenary powers vested in the Commissioner by this Act, especially in regard to preventive inoculation, it was possible to prevent the spread to new land. Only three cases occurred during 1919 and these were confined to the farm where the first outbreak appeared, and one in 1920. That further cases developed here was entirely due to the owners' total disregard of orders, coupled with ignorance and cupidity. It was on this farm that a bull, said to have been struck by lightning, was killed, the carcass taken to the municipal slaughter house for inspection and stamping and there discovered by the inspector in charge to be infected with Anthrax, and this office notified. Subsequently the perpetrators of this attempted outrage were convicted, fined $50.00 each and served thirty days in jail. Quarantine was placed on this farm and not removed. During April, 1920, the owners of the cattle desiring to remove to another farm were allowed to take the stock away after thorough disinfection was given each animal. No farm product was allowed to be taken to the new place. No further trouble has since arisen in this herd, although a year has passed.

Funds sufficient to reimburse the owner for burning the barn and its small remaining contents after removal of the cattle not being available, it was arranged with him to pull down and sell the barn for firewood. Later events proved the danger of this course as a portion of the wood, bought ostensibly for burning, was used to construct a small shed into which was placed three cows, one of which promptly developed a case of anthrax. Immediate vaccination checked the further spread of the disease to the other two. Unmistakably the germs were carried in the wood and thus the cows were infected.

Bearing on this point, it would seem that provision should be made whereby owners could be remunerated for property deemed necessary to be destroyed by the Commissioner in combating the spread of the contagion.

That Anthrax can be controlled through quarantine measures and preventive inoculation is a proven fact, but until owners of cattle realize the danger of hiding the cases of sudden death among their livestock, Anthrax bids fair to be a matter difficult of solution even with the most constant vigilance and a firm hand in enforcing preventive measures against and in handling outbreaks of this fatal disease.

RECORD OF ANTHRAX OUTBREAKS.

Year	Bristol	Hartford	Newington	Total
1917	10	0	0	10
1918	16	14	5	35
1919	0	3	0	3
1920	0	1	0	1
Total	26	18	5	49

In combating the outbreaks special attention is called to the valued assistance rendered by the State and Local Boards of Health, particularly of the City of Hartford, in seconding the vigorous methods deemed necessary in accomplishing the ends in view.

SWINE.

At the time of assuming office, July 15th, 1917, the swine industry of the State was confronted by a most alarming condition through ravages of Hog Cholera. Beginning in 1915, Cholera had continued to increase, largely through misdirected use of serum and virus in the hands of incompetent persons, until it was estimated that the number of hogs in 1916 had been reduced to less than 50,000 in the entire state.

Responding to the recommendation of my predecessor in office in his last report, "An Act Concerning the Suppression of Hog Cholera" was passed January, 1917, and work had been done to some extent in combating the condition fast disseminating the hog population of the State.

Vigorously applying the power given the Commissioner by the new law over the control of Hog Cholera prevention and eradication, particularly with regard to the possession and use of serum and virus, it was possible to create a system of procedure whereby the veterinarians throughout the State, after instruction in a certain uniform technique regarding the application of serum and virus, were able to assist the Commissioner without the necessity of establishing a permanent working force for this specific purpose.

The outbreak of 1915-1917 was controlled by the end of 1917, with a constantly increasing demand for preventive inoculation largely from the worst infected areas where the success of the treatment was most apparent.

The manner of controlling the sale of serum, virus and bacterin through two agents only and shipment by them direct to the applicant C. O. D. on order from the Commissioner has proved a most satisfactory method of handling this very vexatious matter, especially as the State is relieved of all financial responsibility to the makers of the medicants used, which now has assumed very large proportions.

During the latter part of 1918, the so-called "Swine Plague," Hemorrhagic Septicaemia (a disease closely associated with Hog Cholera), assumed such proportions that in many instances threatened to undo our good work in Hog Cholera sections.

After mature deliberations with swine owners, it was deemed advisable to increase the scope of the Commissioner's powers to cover all infectious diseases of swine, and to that end the legislature was petitioned and House Bill No. 680 was introduced and passed, amending Section 2098 of the General Statutes to provide for the control of Hemorrhagic Septicaemia and kindred diseases.

Thus with ample power at command, supplemented by a skilful working force, this department has been able to render most efficient and successful treatment in all of the contagious diseases effecting the swine of our State with the gratifying result of a large increase in the swine industry manifested by importations of pure bred hogs for breeding purposes, formation of pig clubs, and especially by the generous methods of our pure bred breeders in making it possible for anyone to obtain properly inoculated pure bred stock for the good of the industry at nominal prices. This has only been made possible by the successful treatment afforded through State aid in controlling swine diseases.

Since the commencement of the work in 1917, $24,257.90 has been expended for Hog Cholera and Hemorrhagic Septicaemia treatment of 51,000 head of swine in response to 2,171 applications received. Inspections, post mortems, quarantine work and disinfection caused a further outlay of $1,521.60, thus totaling an expenditure of $25,779.50, whereby the situation existing in 1916-1917 was overcome and the raising of hogs in Connecticut placed upon a paying basis, as evinced by the ever increasing number of applications reaching this office.

As a summary of the work done in combating swine diseases from June 1917 to June 30, 1920, the following table is of interest, showing number of hogs treated by years, cost of inoculation per head to the State, etc.

RECORD OF PREVENTIVE INOCULATION AGAINST HOG CHOLERA, HEMORRHAGIC SEPTICAEMIA, AND KINDRED DIESASES.

	1917	1918	1919	1920
Number of applications rec'd	121	799	500	751
Total number of swine treated	6068	12032	11991	16325
Number single treated for Hog Cholera	no record	6238	7439	10384
Number double treated for Hog Cholera......	no record	5794	4552	5526
Number treated for Hemorrhagic Septicaemia..	....	....	5570	16325
Number treated for Hemorrhagic Septicaemia, 2nd treatment	....	....	72	4237
Number treated for Hemorrhagic Septicaemia, 3rd treatment	....	....	....	277
Number of herds infected.	no record	171	167	279
Number of inspections made in addition to inoculations	....	103	50	62
Veterinarians' fees for treatments	$2,035.85	$7,007.92	$4,825.79	$10,388.34
Veterinarians' fees for inspections, post mortems, quarantine and disinfection	00.00	733.71	318.06	469.83
Average cost of inoculation, including inspections and quarantine work, per pig........	.34	.58	.40	.50

SWINE IMPORTATIONS.

Fiscal Year	Total Number	Immediate Slaughter	Breeding
1917	2214	248	1966
1918	138609	137067	1542
1919	124343	123935	408
1920	34146	33811	335

GLANDERS.

Following up a suspected case of glanders in Norwich, a most surprising condition was revealed. During the cleaning up of the stables, every horse in the city was examined and tested, with the result of detecting 18 glandered horses out of 485 tested, and this in a part of the State supposedly free from the disease.

This was closely followed by work in the city of New Britain, where matters developed a far more serious state of affairs. Systematic testing of all horses (920) produced 52 reactors taken in all parts of the city and unfortunately among some of the very best work horses from the largest concerns. That the work was efficiently done has been well proven by only one test case in Norwich and none in New Britain since the examination of three years ago.

Trial tests in other parts of the State soon convinced the Commissioner of the prevalence of glanders throughout the State to an extent heretofore unsuspected, demanding immediate attention. With this in mind a thorough canvass was made, disclosing the fact that if we were to control the disease in the State, the importation of glandered horses from without the State would of necessity have to be stopped or any effort at cleaning up the State would be of very little permanent value beyond the mere removal of reacting horses.

In order to prevent the entrance of horses with glanders, twenty-three points of entry were established under the direct supervision of one or more inspectors, through whose hands all imported horses pass before being released from quarantine. Transportation companies are required now to hold all arriving horses until released by inspector upon presentation of acceptable test charts; otherwise they are re-tested at once before release. By this means, from January, 1918, to June 30th, 1920, seventy-four horses affected with glanders were caught at our borders and killed at a minimum cost to the State. Likewise our method, now well understood at certain shipping points, has had a very deterrent effect on the sending of diseased horses into Connecticut by those more interested in the immediate gain obtained by selling a glandered horse than by reporting it to the proper authorities that it might be destroyed.

This constant supervision over the exclusion of infected horses from without, in addition to examination and testing of native horses by the ophthalmic method and testing all horses that have been in contact with any glandered animal, the abolition of the old working quarantine and prompt killing of every reacting horse has resulted in vast improvement.

The thorough, systematic work accomplished, although very difficult at first, has now, thanks to the hearty co-operation of the veterinarians, become largely automatic with increasingly beneficial results. From September 30th, 1917, to June 30th, 1920, this work has been conducted in the cities and surrounding territory of Greenwich, Stamford, New Haven, Hartford, New Britain, Norwich, and the towns of Ellington, Enfield, East Granby, Granby, Manchester, Putnam, Somers, South Manchester, Stafford, Suffield, Windsor, Windsor Locks, and West Hartford. In performing this work, 7,359 horses were ophthalmic tested, with detection and killing of 720 glandered horses, with a remuneration of $34,730.00 to the owners therefor, not including those showing physical symptoms of the disease.

All of the glanders eradication work has been accomplished by the assistance of the local veterinarians under the personal direction of the Deputy Commissioner, as no salaried force sufficient to cope with so large an undertaking throughout the State is employed by the Department. I take pleasure in calling your attention to the efficient manner in which the veterinarians of the State have assisted this office in this at times very dangerous and disagreeable business. A large part of the work was of necessity performed at night, regardless of weather conditions, especially that connected with the cleaning up of Hartford, the same being done during the unusual winter of last year. It is doubtful if another State is as fortunate in having at its disposal a trained force of veterinarians at so small a cost as is to be found at the call of this office.

With proper appropriation and the knowledge gained by our past efforts in eradication of this disease, provided the points of entry are properly guarded and all suspects followed to the end, I firmly believe glanders in Connecticut can be controlled.

RECORDS.

	1917	1918	1919	1920
No. of horses examined and tested	305	3466	1210	2378
No. of horses condemned and killed	138	313	75	194
Per cent. glandered horses	45%	9%	6%	8%
Total amt. paid owners	$845.00	$16,975.00	$2,690.00	$14,220.00
Average amount per head	38.40	71.92	70.78	73.27

HORSE IMPORTATIONS.

	1917	1918	1919	1920
Number tested before shipment	3412	1917	3437	2198
Number tested after arrival	1141	2149	2381	2431
Number re-tested in Connecticut	0	1105	1137	848
No test charts	383	301	318	603
Total	4936	5472	6136	5232
Number condemned and killed for glanders	0	34	27	13

SHEEP IMPORTATIONS.

Fiscal Year	Total	Slaughter	Breeding
1917	1662	928	734
1918	1605	1316	289
1919	228	170	58
1920	3830	3219	611

MISCELLANEOUS PROSECUTIONS AND CONVICTIONS—

Year ending June 30, 1920.

2—Bringing horses into the State without permit or certificate.
1—Bringing cattle into the State without permit or notification, 5 counts.
1—Violation of quarantine of milk from diseased cows.
1—Violation of hog quarantine.

RECORDS.

	1917	1918	1919	1920
Traveling expenses of Commissioner	$ 160.23	$ 612.54	$ 198.80	$ 324.63
Special traveling expenses of Commissioner authorized by the Governor	......	114.98	125.43	464.67
Traveling expenses of Deputy Commissioner	1,324.20	982.00	787.14	900.50
Special traveling expenses of Deputy Commissioner authorized by the Governor	103.88	......	......	182.07
Salaries (including clerical assistance)	1,043.97	3,172.73	2,627.33	3,594.95
Printing and postage	639.08	1,474.61	1,307.36	689.74
General office expense	2,382.16	3,679.41	2,691.31	3,135.66
Veterinarians, services and expenses, for hog cholera (*a*) (*b**)	2,208.71[a]	7,703.00	5,186.85	10,704.27
Veterinarians, services and expenses for diseases other than hog cholera*	2,126.37	10,472.18	7,277.84	16,084.02

(*a*) $2,208.71 drawn from appropriation for "Expenses of and assistance to Commissioner," as appropriation for "Suppression of Hog Cholera," not available until October 1, 1917.

(*b*) Chap. 134, P. A. 1917, was amended by Chap. 119, P. A. 1919, to include hemorrhagic septicaemia and kindred diseases.

DOGS AND RABIES.

On taking office July 15, 1917, a very serious and widespread epidemic of rabies existed in Connecticut, which had necessitated muzzling orders in forty-two towns. It was very evident that stringent efforts must be taken to control this epidemic.

In most of our cities there are large numbers of dogs, either roaming or vagrant, acting as scavengers. It would be hard to find any *civilized* communities where the value of the dog as a scavenger is officially encouraged. In thickly populated districts there is no reason why the dog should be allowed to roam at will, committing depredations and spreading filth and disease. Allowing dogs the same freedom of public thoroughfares as pedestrians is an "exhibition of filthy practice and sanitary disregard which is unequalled in the whole world. All about the country there is an ever-increasing accumulation of unnecessary and entirely useless dogs for whose existence there is no justification other than the gratification of a foolish fad or misguided fancy, yet each constitutes in itself an increasing source of danger."

Rabies is very easily controlled and could be eradicated by enforcing two very simple rules, and the ease with which this could be accomplished makes it a crime against the integrity of the State not to take steps to eradicate this evil.

By the proper control of dogs rabies can be absolutely eradicated, it being only necessary to prevent dogs from coming in contact with other dogs to bring this about. As the time progresses and the rules concerning dogs now in effect are enforced this fact is becoming well-known.

The first measure toward the eradication of rabies is the impounding by dog wardens of all stray dogs not in proper control of some person, and the killing of the same if not redeemed.

The second measure is for owners of dogs to keep their dogs under their control at all times.

The same effect is obtained in the prevention and spread of distemper, which is the most serious disease of dogs, and which is very contagious, probably causing fifty per cent. of the deaths of dogs dying from disease. Mange, another disease common to dogs, is also preventable in this way.

Disease in sheep also is greatly lessened by keeping dogs under control. Most of the diseases to which sheep are subject are caused by internal or external parasites, and during the cycle of life of several internal parasites, notably the fringed tape worm, the parasite must pass through the system of the dog before being developed in the sheep. This is another reason why dogs should not roam at will.

As it is acknowledged by everyone interested in sheep husbandry that dogs are the worst menace to this industry, and in view of the above facts it was earnestly recommended that the legislature pass laws providing for the proper control and care of dogs when not on the owner's premises, as there appears to be no more reason why dogs should be allowed to roam at large, commit depredations, and make themselves a menace to public health and private property than that any other domestic animals should be given these privileges.

In view of these facts it became necessary to issue a quarantine on all dogs in the one hundred and nine towns west of the Connecticut River, and eventually in twenty-three towns in the northeast section of the State. During the time this quarantine was in effect eleven thousand six hundred and fifty-four dogs were killed, and the conviction was obtained on one thousand three hundred and ninety-seven persons for the violation of the dog laws and quarantine rules. This quarantine was in operation for about two years, 1917 and 1918. The enforcement of the quarantine rules and, later, after the 1919 session of the legislature had passed the roaming dog law, the enforcement of the roaming dog law has resulted practically in the elimination of the disease of rabies in Connecticut. The roaming dog law will in the future, if enforced, take the place of area quarantines.

The roaming dog law, enacted by the 1919 legislature, requires the owner of a dog to be responsible for the dog at all times, and makes it illegal for the owner to allow his dog to roam beyond his call and control when not upon the owner's premises. The rigid enforcement of this law will eliminate to the minimum damage by dogs.

The amount of damage by dogs reported in the last four years is as follows:

Year ending May 1, 1917	Year ending May 1, 1918	Year ending May 1, 1919	Year ending May 1, 1920
$11,559.71	$17,170.29	$8,428.47	$8,594.86

During the time the quarantine on dogs was effective the world war was waging and upon the urgent appeal of the representative of the United States War Department for dogs to be used in the gas investigation, and in compliance with Rule 4 of "Rules Concerning Dogs in Certain Towns," the commissioner directed that dog wardens should dispose of all stray dogs that they might find at large without collar and license tag, unredeemed by owners, by sending the same to the United States Gas Warfare Investigation to be killed. As a result of this order 4,469 dogs have been sent to this investigation. The following is a copy of a letter received from the officer in charge of this investigation:

"The investigation of the Chemical Warfare Service of the War Department, conducted at Yale University under the direction of the undersigned, is concerned mainly with defense problems in connection with gas warfare. The results thus far obtained have been far reaching from a practicable standpoint and of the utmost importance in the saving of human life. The work has been greatly facilitated by the co-operation of the Commissioner of Domestic Animals in supplying this station with dogs for experimental purposes. Without such co-operation the investigation would be well-nigh impossible. It is earnestly requested that the co-operation of the Commissioner of Domestic Animals may continue and thus render to the country an invaluable service.

(Signed) FRANK P. UNDERHILL,
Lieutenant-Colonel, C. W. S., U. S. A.,
In charge U. S. Gas Investigations at
New Haven."

During the campaign to enforce the quarantine on dogs and the roaming dog law it was found that many towns were negligent in the appointing of active dog wardens, and in some towns no dog warden was appointed. This necessitated the appointing of dog wardens by the Commissioner in accordance with Chapter 242, Public Acts of 1919. During the year ending July 1, 1920, the Commissioner appointed seventy-five dog wardens in as many towns. As dog wardens so appointed are under direct control of the Commissioner on Domestic Animals, it has been possible to demand active work along this line.

The Commissioner was called on fourteen times in the two years ending June 30, 1920, to appraise dog damage to domestic animals, in accordance with Chapter 203, Public Acts of 1919.

Quoting from the 1919 report of Massachusetts:

> "Had it not been for the very thorough and efficient control work carried on by the authorities of the neighboring State of Connecticut, where rabies has extensively prevailed for the past three years and where several thousands of unlicensed dogs have been destroyed during that period, we would undoubtedly have been confronted with a much more serious condition than now exists."

NUMBER OF CASES OF RABIES REPORTED.

Jan. 1, 1917, to Oct. 1, 1917	150
Oct. 1, 1917, to Oct. 1, 1918	110
Oct. 1, 1918, to July 1, 1919	65
July 1, 1919, to July 1, 1920	21
	346

CONVICTIONS IN ENFORCEMENT OF DOG LAWS.

	Obtained by Special Deputies	Obtained by Dog Wardens
Jan. 1, 1917, to Oct. 1, 1917	...	...
Oct. 1, 1917, to Oct. 1, 1918	501	415
Oct. 1, 1918, to July 1, 1919	238	243
July 1, 1919, to July 1, 1920	192	182
Total	931	840

CASES NOLLED IN ENFORCING DOG LAWS.

	Special Deputies	Dog Wardens
Jan. 1, 1917, to Oct. 1, 1917	..	...
Oct. 1, 1917, to Oct. 1, 1918	97	136
Oct. 1, 1918, to July 1, 1919	18	32
July 1, 1919, to July 1, 1920	9	38
Total	124	206

DOGS CAPTURED.

	Licensed and Roaming	Unlicensed
Jan. 1, 1917, to Oct. 1, 1917	....	....
Oct. 1, 1917, to Oct. 1, 1918	....	....
Oct. 1, 1918, to July 1, 1919	1027	3285
July 1, 1919, to July 1, 1920	2910	2853
Total	3937	6138

	Dogs Killed	Dogs Redeemed	Dogs Sold
Jan. 1, 1917, to Oct. 1, 1917	....	....	....
Oct. 1, 1917, to Oct. 1, 1918	7686	1879	....
Oct. 1, 1918, to July 1, 1919	3968	752	....
July 1, 1919, to July 1, 1920	4166	681	86
Total	15820	3312	86

The following money was paid to special deputies enforcing the dog laws, and for incidental expense, said money being paid by the State Treasurer on vouchers issued from this office, as provided in Section 4, Chapter 296 of Public Acts of 1917:

1917	1918	1919	1920
$694.09	$7,549.91	$3,921.65	$9,075.05

The following money was received from special deputy for witness fees collected in connection with prosecutions under Chapter 296 of Public Acts of 1917, and returned to the State Treasurer:

1917	1918	1919	1920
....	$242.28	$172.27	$91.99

	1917 Series	1918 Series	1919 Series	1920 Series
Dog license tags ordered by Town Clerks.......	71944	69605	68890	68130
Kennel license tags ordered by Town Clerks.....	777	1212	1388	1751
Total number tags order-by Town Clerks.......	72721	70817	70278	69881*
Number of Kennel licenses	77	117	137	173*

	Year ended Sept. 30, 1917	Year ended Sept. 30, 1918	Nine months June 30, 1919	Year ended June 30, 1920
Paid for tags from State appropriation	$1,073.57	$1,061.57	$ 968.80	$1,019.89
Paid for tags from receipts from towns	11.72	17.91	13.37	20.15
Paid for advertising muzzle and quarantine rules	551.08	.....	.....	.....
Paid for advertising quarantine orders and printing	.....	224.14	86.75	68.25
Received for tags........	3,742.95	3,446.45	3,248.30	3,599.80
Paid State Treasurer.....	3,180.15	3,206.40	3,148.18	3,511.40

*To June 30, 1920, only.

SUMMARY.

CATTLE.

	Examined	Condemned
Total number bovines physically examined in four years	4885	784
Total number tuberculin tested by State in four years	8530	1756
Total number tuberculin tested co-operative State and Federal test—1 year 3 months	6016	991
Total	19431	3531
Total number of test charts examined for cattle brought into the State	15255	

ANTHRAX.

Total number of cattle vaccinated for anthrax	1917	62
" " " " " " "	1918	253
" " " " " " "	1919	298
" " " " " " "	1920	233
Total		846

SWINE.

Total number of hog cholera treatments (4 years)	46001
Total number of hemorrhagic septicaemia treatments (2 yrs.)	26481

GLANDERS.

	Tested	Killed
Total number of Connecticut horses tested for glanders	7359	720
Total number horses re-tested after arrival in Connecticut	3090	....
Total number of horses brought into State which were killed for glanders	...	74
Test charts examined and passed on for horses brought into the State	10964	

DOGS.

Total prosecutions for violation dog laws	2101
Total number dogs captured and impounded	10075
Total number dogs killed	15820

Respectfully submitted,

J. M. WHITTLESEY,
Commissioner.

UNIV. OF MICH.

"THE SEASIDE" AT NIGHT.

State of Connecticut

PUBLIC DOCUMENT No. 53

REPORT

OF THE

State Tuberculosis Commission

TO THE GOVERNOR

**For the Period Beginning October 1, 1918
and Ending June 30, 1920**

PRINTED IN COMPLIANCE WITH STATUTE

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THE BOARD OF CONTROL

STATE TUBERCULOSIS COMMISSION.

Dr. Stephen J. Maher, New Haven. . Term expires July 1, 1923
Wallace S. Allis, Norwich. . . . . Term expires July 1, 1925
Arthur R. Kimball, Waterbury. . . . . . Term expires July 1, 1921

Secretary

George I. Allen. . . . . Middletown.

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REPORT
OF THE
STATE TUBERCULOSIS COMMISSION
State of Connecticut

To His Excellency, The Governor of Connecticut, and the Members of the General Assembly:

In compliance with the requirements of the law of the State, we herewith submit to you a report of our activities during the past twenty-one months. These months, of course, run back to the time of the Great War and include the whole troublous time of reconstruction.

During this time, there has been a shatttering of so many political institutions and of so many political and social beliefs, that it would seem desirable in this, the first after-the-war report of the State Tuberculosis Commission, to make a frank survey of our present status and of the status of our five State Tuberculosis Sanatoria.

OUR VARIOUS ACTIVITIES.

In no other state, so far as we know, is there a central official body like the State Tuberculosis Commission of Connecticut, of whom so much is expected, or to whom so much authority is given. Briefly, our duties as outlined by the state are (1) to erect, maintain, and manage the State sanatoria; (2) to keep the General Assembly informed as to the tuberculosis situation in Connecticut; (3) to publish for the enlightenment of the general public articles on the more important recent developments in the anti-tuberculosis campaign; (4) to supply to the factories and stores and schools of the state, placards and tracts summarizing the essential truths about the best methods of preventing the spread of tuberculosis in factories, stores and schools; (5) to encourage the making of public addresses on tuberculosis. As a corollary to these statutory requirements and in order to keep Connecticut in the front of the fight against tuberculosis, the Commission has, during the past few years, exerted itself in the establishment of tuberculosis clinics and dispensaries and consultation services in various parts of the state. After these local anti-tuberculosis agencies have been established we have assisted in their functioning by loaning to them, at various specified hours in the week, the exceedingly valuable services of the tuberculosis experts on our sanatoria staffs. Dr. Stockwell and Dr. Strobel have done this work of diagnosis and consultation at New Britain and Bristol; Dr. Dinnan and Dr. Gibson at Meriden and Middletown; Dr. Lynch at Bridgeport, Fairfield, Stratford, Milford, Derby, Stamford and Greenwich; Dr. Campbell at Norwich, New London, Danielson, Putnam, and Willimantic. In the difficult zone of the diagnosis of suspected tuberculous bone conditions, we hope, in the near future, to offer to the state the assistance of the experts of The Seaside. More and more every year this sort of field work against tuberculosis is receiving the acclaim of all the advanced students of the great problem. It is the work that the Framingham demonstration has proven most worth while. It is the best fruit of all the so-called tuberculosis surveys that have been begun within the last few years. As the results have shown, it is a work that has not been better done anywhere than in Connecticut.

Of course, we do not deserve credit for all of this work done in Connecticut. In New Haven there are in operation two tuberculosis dispensaries: one connected with the New Haven Hospital and the other with Grace Hospital. Moreover, the New Haven Visiting Nurse Association has a permanent staff of fourteen tuberculosis nurses, of whose work no praise would be excessive. In Hartford there is an independent tuberculosis clinic and considerable case finding and follow-up work is done by nurses of the Hartford Society for the Prevention of Tuberculosis. Waterbury has an independent tuberculosis clinic. And at all the cities and towns we have mentioned as places assisted by our sanatoria physicians, the main burden of the upkeep of the tuberculosis clinics and dispensaries and consultation is borne by the local authorities or by the local organization that acts as our agent for the sale of Christmas seals.

ARE WE SAVING LIVES?

Six years ago, in our report of 1914, we raised the question of whether our activities resulted in an appreciable saving of lives in Connecticut. A paragraph of that report is still to the point:

"In considering the reduction of the death rate in Connecticut from tuberculosis during recent years the scoffers sometimes remark that the general death rate from all diseases has declined in about the same proportion as the tuberculosis death rate. Even if that were true—and it is not—it should be borne in mind that the anti-tuberculosis agitation has not only saved the lives of citizens infected with tuberculosis, and of citizens who otherwise would be infected with tuberculosis, but it has been a principal agency, perhaps the principal agency, in the development of the whole modern campaign for cleanliness—for clean food and drink, clean homes, clean factories, clean stores, clean streets, clean theatres, clean trains, clean trolley cars—yes, even clean lives. It is only fair, then, to assume that a large share of the reduction in the general death rate is ascribable to the anti-tuberculosis crusade. But from whatever point of view one looks at the figures, they are interesting and heartening."

In 1884, out of every 100,000 people in the state 215 died of consumption. In1913, out of the same number only 122 died of consumption; in 1918, only 126; and in 1919, only 101. Thus it will be seen that proportionately to population, there were not half so many deaths from consumption in Connecticut last year as there were in 1884. Again it will be seen that the preventing of 114 death in every 100,000 means an annual saving of the lives of nearly 1,500 residents of Connecticut. Another point to be borne in mind is that consumption has been very frequently described as "a disease of over-crowding"; but in Connecticut in 1884, there were only 762,120 people in the state and last year there were twice as many, or about 1,300,000, and yet the death rate from tuberculosis was not half as large last year as it was in 1884.

In Connecticut in 1884, out of every 100 deaths from all causes, 13 died from tuberculosis of the lungs and 14.5 from all kinds of tuberculosis. In 1913 only 9.3 of every 100 deaths were caused by tuberculosis of all kinds. In 1918, because of the enormous number of deaths from influenza, the deaths from tuberculosis, although numerically greater than in 1913 or 1919, fell to the low rate of 7.4 per hundred of all deaths. In 1919, 9.1 of every 100 deaths from all causes were due to tuberculosis.

The average consumption death rate for Hartford County for the 35 years previous to 1913, was 167 per 100,000 of population; in 1913, the rate per 100,000 was only 115; in 1918 it rose to 124; and last year it dropped to 113.

The average consumption death rate for New Haven County for the 35 years previous to 1913 was 181 per 100,000 of population; in 1913, the rate per 100,000 was only 123; in 1918 it rose to 127; in 1919 it dropped to 103.

The average consumption death rate for New London County for the 35 years previous to 1913 was 181 per 100,000 of population; in 1913 was 145; in 1918 itrose to 192 per 100,000, and last year it fell to 169 per 100,000.

The average consumption death rate for Fairfield County for the 35 years previous to 1913 was 167 per 100,000 of population; for 1913 the rate per 100,000 was only 139; in 1918 it fell to 120, and in 1919 it dropped further to 105.

The average consumption death rate for Windham County for the 35 years previous to 1913 was 161 per 100,000 of population; in 1913 it was only 77 per 100,000; in 1918 it was 74; and in 1919 it rose to 81.

The average consumption death rate for Litchfield County for the 35 years previous to 1913 was 131 per 100,000 of population; in 1913 it was only 88 per 100,000; in 1918 it was 85; and in 1919 it dropped to 55.

The average consumption death rate for Middlesex County for the 35 years previous to 1913 was 131 per 100,000 of population; in 1913 it was 128 per 100,000; in 1918 it rose to 158; and in 1919 it dropped to 126.

The average consumption death rate for Tolland County for the 35 years preceding 1913 was 135 per 100,000 of population; in 1913 it was only 70 per 100,000; in 1918 it rose to 81, and last year it dropped to the lowest rate in the state, only 41 per 100,000 of population.

"THE SEASIDE."

In our last report we told of our purchase of the unused White Beach Hotel at Crescent Beach, Niantic, and of our intent to utilize the property for the caring of children afflicted with bone and glandular tuberculosis. We could not, at the time of writing that report, foresee that our proposed conversion of the old hotel into a home for our ailing little ones would meet with more than a perfunctory opposition from our Crescent Beach neighbors; but, as all who had to do with the last General Assembly, or who even read the newspaper accounts of the legislative happenings of the winter and spring of 1919, were made to realize, our innocent project was assailed bitterly, continuously, openly, and under-handedly from the beginning of the session to its very last day, and only on this day did the contemners of our efforts to heal our crippled children admit that their efforts to harden the great heart of Connecticut were vain. For our victory we owe very special gratitude to the newspapers of the

ON "THE SEASIDE'S" SUNNY BEACH.

UNIV. OF MICH.

state, to Governor Holcomb, to Attorney-General Healey, to Comptroller Webster, and to the members of the Board of Finance and the Committee on Appropriations. Of course, we had the support of all the humanitarian and social organizations of the state, and we would hereby thank them, one and all, for the valuable time they and their representatives spent in holding meetings and attending legislative hearings concerning this matter of securing a bit of Connecticut's beach for the cure of some of Connecticut's crippled children. Of course, now that "The Seaside" is open and is operating at full capacity, to the great delight of the very people who were most bitter in opposing its establishment, it is easy to see, and easier to say, that the opposition that we encountered in the last legislature was based on misinformation and that the leaders of this opposition were not as inhuman as their doings and sayings of the winter and spring of 1919 make them appear to be; nevertheless, glad as we are of their present and anxious as we are for their future approval as well as for that of the whole state, we cannot dismiss the subject without asking them to realize, and asking the whole state to realize, that if their bitter opposition in the last General Assembly had succeeded, there would not be in Connecticut now, nor for a great many years, any such institution as The Seaside. We, therefore, commend to the gratitude and regard of the state all those fine officials and citizens and organizations who fought so valiantly for the right and for the children's right, as to make the long-talked-of and long-prayed-for Seaside an actually functioning institution.

"THE SEASIDE" FUNCTIONING.

When the morning sun takes his earliest peep out of the East at the Connecticut shore and Long Island Sound, one of the first places to attract his attention is a short stretch of shining white beach to the west of McCook's bluff at the mouth of the Niantic River. And when the evening sun is sinking behind the western horizon, his last farewells are made to the tower and flag-pole of a big white building with glass-enclosed verandas that stands on a little elevation one hundred yards back of the little stretch of white beach. That beach and that building are The Seaside.

Headlands to the east and west distant five or six miles, protect it from the fury of all but southerly storms, and enframe the succession of continually changing and fascinating ocean views that are to be had from three sides of the building and from all parts of the grounds. A dozen miles to the south lie Gull Island and Little Gull Island, and Plum Island; and beyond them rolls the Atlantic Ocean.

After many irritating delays and disappointments, the Seaside received its first patients in January of 1920. The severity of the wintry weather of the following weeks, the impassable condition of the roads of the state and the difficulties of the managers of the steam and trolley line operated to keep the number of patients down very low uniil spring, but by July 1st the institution had received 45 patients, which is about as many as under present conditions it can accommodate. The institution has 58 beds, but it is necessary to keep in reserve a few rooms for the isolation of cases of measles or other of the contagious diseases sure to occur occasionally among 45 children under 14 years of age.

It is so short a time since the opening of the institution that it would be imposible to make in this report any definite statement as to the effect of the treatment to which the children are subjected at the Seaside; but it is only fair to say that the apparent results are good, surprisingly good; so good, in fact, as to convert into enthusiastic friends of the institution physicians' who, until they saw for themselves, were doubting Thomases.

The treatment to which the children are subjected is heliotherapy; treatment by more or less continuous sun-baths, that is, by the exposure of the whole body to the sunlight. This is not the place to discuss this treatment in detail; but to readers who are interested, the Commission will furnish explanatory pamphlets. And we hope that before the Assembly adjourns, as many as possible of the members will honor The Seaside with a visit, and observe for themselves, the wonderful things the sunlight is doing, winter as well as summer, to the little wards of the state, in this new Connecticut institution.

A Revolutionary Doctrine.

Until the last few years, it was generally accepted that human tuberculosis was simply a contagious disease and that, when an adult developed symptoms of tuberculosis, he did so because he had recently been infected by inhaling the germs of tuberculosis fresh from the breath or sputum of somebody else who had tuberculosis. During the last few years, this theory has received some severe blows, and now it is a question, and a very important question—how much longer it can stand. The first blow was struck by Calmette of France and his followers, who claimed that they had proved that pulmonary tuberculosis could not be caused by the inhaling of the germs of the disease, but that pulmonary tuberculosis could be caused and always was caused by the taking of the germs of the disease into the stomach and bowels, whence they were carried by the blood to the lungs. The second blow, or rather the second series of blows, was struck by a host of authorities in various countries, notably by Von Behring in Germany, Fishberg in America, and H. Battey Shaw of England. According to these authorities and their followers, practically all civilized human beings are infected with tuberculosis during childhood, and practically all tuberculosis in adult human beings is the result, not of recent infection, but is the belated development of the infection of childhood. This revolutionary theory is far from being generally accepted, but its mere discussion has had the effect of forcing us all to realize the importance of making more serious efforts to control the tuberculosis of children.

MERIDEN SANATORIUM FOR CHILDREN ONLY.

In order to keep Connecticut in the lead in this new movement for the saving of children, we have decided to transform the State Sanatorium at Meriden into a sanatorium for children only. In the beginning of the santorium era, Connecticut, like all other communities, received tuberculous adults and children without discrimination in all her sanatoria. As the number of children increased, and it became necessary to consider the establishment of schools in the sanatoria, it was decided to send the girls of school age to Meriden, and boys of school age and all the infants to Hartford. According to our new plans, the plans adopted this year, all the children suffering with pulmonary tuberculosis will be sent to Meriden and all the children suffering with bone and glandular tuberculosis will be sent to The Seaside at Niantic.

The new arrangement has met with the enthusiastic approval of all the organizations and officials of the state with whom we have had an opportunity to discuss the matter. The only dissatisfied ones, that we know, are the physicians and nurses at the Hartford Sanatorium. They were sorry to see their children go,—even to Meriden. The new arrangement has made it necessary to plan at Meriden a building somewhat different from the one we had in mind when we asked the last General Assembly for our appropriation. We have taken this matter up with the Board of Control and received its assent to our change of plan.

GENERAL HOSPITALS SHOULD HELP.

In our report for the years 1913 and 1914 we first called the attention of the General Assembly to the absurd and dangerous state of panic into which the appearance of a tuberculosis patient threw most of the directors and physicians of general hospitals. In that report, and in subsequent reports, we advocated as strongly as we knew how, that, for the sake of the patient, for the sake of the patient's friends, for the sake of the community, and for the sake of the coming generation of doctors, the general hospitals of the state who received a bonus from the State Treasury, should be compelled to provide a small ward or building in which the emergency and dying cases of pulmonary tuberculosis could be cared for.

Our views on this matter were received with approval by most of the best tuberculosis authorities of the country, and by certain of the teachers of the great medical schools of the country, who were becoming alarmed at the fact that so many thousand of the young doctors who, in late years had been empowered to practice medicine, were deplorably ignorant of that most important of human disease, tuberculosis of the lungs.

But in spite of the fact that two years after the appearance of our first official protest against the phthisiphobiac attitude of the general hospitals, the National Tuberculosis Association passed a resolution calling on all the general hospitals of the country to provide suitable accommodations for emergency and late cases of tuberculosis; heretofore, very little progress has been made toward a consummation of this greatly needed reform. The managers of the general hospitals of the country include many of the most eminent and influential people of the country, and they have not yet been convinced of the urgent need of this reform. And, like most eminent and influential people, they are conservative and they would prefer to see the proposed reform tried out in some other institution than theirs.

APPROVED BY THE SURGEON GENERAL.

Nevertheless, "the truth goes marching on," and we have been greatly heartened by two recent accessions to the cause. The first is Surgeon-General Hugh S. Cumming, of the United

States Public Health Service, and the second is *The Modern Hospital,* the American monthly publication that has, perhaps, the greatest influence on the managers and proponents and architects of the general hospitals of the country. Surgeon-General Cumming, in an official public pronouncement, recommends that every general hospital should admit tuberculous patients and provide separate wards for them. "This provision," he says, "would insure earlier diagnosis, would make possible the training of internes, would popularize treatment in the home climate, would provide convenient facilities for the observation and prompt treatment of patients, and would develop a sharpened perception and higher degree of skill by which the family doctor would make earlier diagnosis, and even forestall the development of clinical tuberculosis in the adult before a definite diagnosis is possible." In endorsing the Surgeon-General's proposal that every general hospital in the country set aside a ward or wards for the definite purpose of treating tuberculosis, *The Modern Hospital,* of July 1st, 1920, says, in its leading editorial, that the question "should now be kept before the public, the medical profession, and those who are responsible for hospital administration until it is properly disposed of. . . The contribution of hospitals to the public service would thus be greatly enhanced, the tuberculosis clinics would be strengthened, the public mind would be swept free of harmful misconceptions, and hospital internes, into whose hands the whole public health movement of the future eventually must be committed, would not enter into practice, as they often do to-day, lacking in the power to make an accurate diagnosis and a reasonably correct prognosis in cases of pulmonary tuberculosis."

Hitherto the representatives of the general hospitals of the state have opposed the suggestion that they receive tuberculosis patients, (1) because of the public's fear of the disease, (2) because of the ordinary physician's fear of the disease, (3) because of the ordinary nurse's fear of the disease, (4) because of the lack of room in the existing general hospitals, and (5) because of the expense involved in providing a special ward for sufferers from tuberculosis. As reasons 1, 2 and 3 are simply a confession of ignorance on the part of their public, their doctors and their nurses, the very kind of ignorance that it is the duty of hospital authorities to cure, there would seem to be need at this time of considering only reasons 4 and 5. The answer to reason 4 is: the Connecticut general hospital that will promise to receive tuberculosis patients as soon as somebody provides it with another small ward or building will not long lack the desired ward or building. The Connecticut public does not permit its hospitals to be crippled for lack of buildings or equipment. As to reason 5, in our last report we said:

"The expense of caring for these emergency cases ought to be borne in part by the State and in part by the town or city. It seems to us that after considering this matter and when considering requests for financial assistance from the various general hospitals of the state, the committee on appropriations could wisely formulate a bill defining the conditions under which the State would help to pay the hospitals for the care of these emergency cases of tuberculosis. The number of these cases would never be large in any one hospital, but the suitability of the care and treatment given ought to have the sanction of the State Tuberculosis Commission, and, of course, we would always be eager to receive into the sanatoria patients from the hospitals who showed any promise of improvement."

We Proffer Assistance.

During the past year the Commission has been called upon by the State Board of Charities for an opinion as to the suitability of the accommodation for tuberculous inmates provided at the State Prison at Wethersfield. With this request of course we gladly complied. We refer to it now because it brings up again the question of whether it should not be the right and the duty of all the state institutions where tuberculous criminals, lunatics or imbeciles are confined, to call on us for such diagnostic and advisory assistance as we, through our staff of tuberculosis experts, can easily give.

Our New Laundry.

During the past year, a central laundry plant, intended to give service to all five of our sanatoria, was established at Hartford. It is already in successful and economical operation, and doing the work for the sanatoria at Hartford, Meriden and Shelton. Our system of motor-truck transport works smoothly thus far, but because of our remembrance of the condition of the state roads during the stormy months of last winter, we are loath to do much boasting at this time. Probably before the adjournment of the General Assembly we shall know whether or not our central laundry is capable of giving as much assistance to all our sanatoria as we expected.

Because of the limitation of our appropriation we were obliged to erect a wooden laundry building, and of a much more flimsy type than we desired, but the equipment of the building is of the most approved and modern kind and, under the skilled management of Mr. Ernest Little, the work turned out by the deft women and the smoothly working machines, is of a kind that rejoices the patients and staffs of the sanatoria.

OUR INFLUENZA EXPERIENCES.

The first wave of influenza, in the fall of 1918 and winter of 1919, carried sickness and death to the inmates of the Hartford and Norwich Sanatoria, and the second wave, in the winter of 1920, to the inmates of the sanatoria at Meriden and Shelton. This mysterious epidemic spared neither the sick nor the well at our institutions. It was no more severe with the patients than with the attending physicians or nurses, but, of course, when it attacked patients whose hearts' energy was already worn thin with tuberculosis, its assault proved fatal more frequently than when it attacked the sturdy help or the ambulant patients. Like most authorities who have studied their cases, we hesitate to come to any definite conclusions in regard to manner of infection or methods of treatment. However, our best results have been in the institutions in which the cases were given a simple alkaline treatment and in which little or none of the blatantly advertised coal-tar derivatives were employed.

COLLECTIVE BUYING.

We have continued our practice of purchasing such staples as butter, eggs, flour, sugar, canned goods, linen and cotton goods, paper goods, beds and bedding, by asking for bids at our office in the Capitol, for all of the sanatoria, and awarding the bids to the lowest responsible bidders. During the past two years, the bidding for canned goods has not been very spirited, but in all the other lines the results have been satisfactory. For instance, because of our early purchase of sugar in carload lots, we are still using, at two sanatoria, sugar for which we paid only 9¾ cents a pound.

DR. JAMES B. DINNAN.

It is our sad duty to report that on October 3rd, 1919, Dr. James B. Dinnan, the superintendent of the Meriden Sanatorium, died of typhoid fever. He had been the superintendent of this institution since its opening. Its great success, despite the many handicaps of the first years, was due chiefly to his ability, his kindness, his enthusiasm and his cheerful and unwavering confidence not only in his own institution but in all of the state's anti-tuberculosis work. He was called upon several times to assist the Commission in restoring the crumbling management or morale of some of the other institutions, and his loyal assistance in the making over of the old White Beach hotel into the Seaside, is something for which we cannot be too grateful. Dr. Dinnan was 38 years old, a native of New Haven and a graduate of the Yale Medical School. During the last year of his life he had become greatly interested in tuberculosis research work and his papers at local and national society meetings were beginning to attract the attention of leading anti-tuberculosis workers of the country.

A Grave Injustice.

Cannot something be done by the General Assembly to prevent the town authorities of the state from classifying as "paupers", and publishing as "paupers", their tuberculous townsmen and townswomen whom they send to the sanatoria and for whose maintenance at the sanatoria the towns pay about one-fourth the actual cost? The State incurs the other three-fourths of the cost of maintenance of these patients, but she does not treat them or classify them or publish them as "paupers". The State treats them and classifies them as sick citizens who come at her invitation to partake of the healing powers that she possesses, and that she feels it her duty to administer impartially to the sick poor and to the sick rich. Of the motives that impel a consumptive to go to the sanatoria, perhaps the most common one is his desire to regain his health, but usually combined with this motive and very often the most forceful motive of the two, is the desire to save the members of his household, especially the children of his household, from the dangers of contracting the disease from which he himself suffers. However, many poor but clean and proud consumptive parents prefer to risk even this danger, rather than expose their child to the contumely in later life of the charge that his or her father or mother was a "town pauper". This practice of so many of the towns of the state is not only a grave injustice to the individual patient, and a cause of rankling bitterness in the hearts of his children, but it interferes with the success of our whole campaign against tuberculosis. It leads to concealment of cases and refusals of treatment, and it compels the hundred or more social and charitable organizations of the state to expend for the payment of patients' board at the sanatoria, contributed funds that ought to be used for the tuberculosis educational and nursing work of the whole community, or perhaps for the support and safeguarding of dependent-families of patients. And the children in the sanatoria for whom the towns or cities pay part-maintenance, these children who, through our ignorance or heedlessness—that is, through the ignorance or heedlessness of the adults of the towns and cities of the state--have been infected with this terrible disease, is it fair to brand them in the town and city records as paupers? Is it humane? Is it christian? Is it social? Isn't it dishonest? And, to put the argument on the most selfish basis, does it pay to be dishonest even with children?

THE HARTFORD SANATORIUM.

The Hartford Sanatorium, situated about five miles south of the State Capitol, on the ridge just west of the Berlin turnpike, continues to be one of the largest of our sanatoria. In our last report, we referred to the fact that the war had robbed us of the highly prized services of our Hartford Superintendent. We are glad to be able to say in this report that Dr. Stockwell has come back to us as Superintendent at Hartford. His executive efficiency and his progressiveness are recognized by all who have become interested in Connecticut's anti-tuberculosis campaign. Since his enlistment, the new central laundry had been erected on the grounds of the Hartford institution, and since his return we have exchanged all the children patients at Hartford for adult patients from the Meriden Sanatorium.

The building in which the male help have been housed at Hartford has been for several years too crowded for comfort. Extensive repairs, inside and out, are now imperative. It is our opinion that it will be wiser to enlarge and repair the building at the same time. We have asked for an appropriation of $7,500 for this purpose. That sum will permit us to double the size of the present building.

The increasing konwledge of the importance of sun-baths in the treatment of tuberculosis, even in the treatment of selected cases of pulmonary tuberculosis, has created a demand at all the sanatoria for increased facilities for the using of this powerful but easily available remedy. A suitable heliotherapy platform at Hartford would cost about $600. Every year the X-ray is coming into more general use. As yet, the Hartford Sanatorium has no X-ray apparatus. We need $2,500 to cover the cost of purchase and installation of one of the smaller machines.

At Hartford, as at all of the sanatoria, and in fact at all institutions, one of the most difficult administrative problems is the securing and retaining of suitable nurses. The nurses' home at Hartford is rather crowded and has no sleeping porches, and, therefore, is not as attractive as it should be to the modern tuberculosis nurse. Seeing in her patients the results of overcrowding, and knowing the benefit they derive from sleeping in the open, she naturally demands sun and fresh air for herself. To provide sleeping porches at the nurses' home we shall need $3,000.

In order to make advantageous use of the buildings and beds at the Hartford Sanatorium, it will be necessary to add to them, a small "women's shack", that is, a building for the housing of the early and milder female cases. These cases are now cared for on the upper floor of what was heretofore the shack for women and children. On the first floor of this building the beds are now occupied by the moderately sick women and girls. For administrative reasons and for medical reasons, it is greatly to be desired that the "almost well" cases and "the hardly sick" cases should live in a building separate from "the bed cases".

THE MERIDEN SANATORIUM.

It is difficult to speak of Meriden Sanatorium without speaking of the big genial Dr. Dinnan, who was its Superintendent from its opening, and who, as we have related above, died last October. His successor is Dr. Cole B. Gibson for two years Dr. Dinnan's assistant, a young physician whose executive capacity was not only clear to us but was utilized and highly approved by the army authorities during the war. Our expectations as to the future of the Meriden Sanatorium, in its new role of a sanatorium for children only, are very high. It would be hard to find in the state a location for such an institution more sightly or more convenient than the wooded face of the Meriden mountain where the white buildings of the Meriden State Tuberculosis Sanatorium for Children now nestle among the trees.

At all of the sanatoria, the superintendents again make requests for an appropriation for "recreation halls". And undoubtedly proper recreation hall buildings would add to the attractiveness of all of the sanatoria. We have hesitated about endorsing these request because of the expense involved and because the buildings have not been an essential. At the Shelton Sanatorium we have provided a recreation hall by making over for that purpose, the whole first floor of what was formerly used as a nurses' home; the upper floor is now used for the housing of male help. In the other institutions there are no places of assembly except the large dining rooms and the little central rooms in the various shacks. The arguments in favor of establishing these recreation halls at the Hartford, Norwich and Meriden sanatoria are a little stronger this year than heretofore because of the increased opportunities nowadays for entertainment. Thanks to the generosity of National officers of the Knights of Columbus and other friends of the sanatoria, three of the institutions are now equipped with fine moving picture machines, and in the fourth, Hartford, the proprietors of the local theatres bring their own machines and films to delight the patients. Of course, it would be safer, more sanitary, and less disturbing to the machinery of the sanatoria to have these and similar entertainments given in a proper assembly hall than in the general dining room. The Meriden Sanatorium has a special claim to make in the matter of the need of a recreation building. As Meriden, in the future, will have only children patients, it will be necessary to have some proper place apart from the dormitory buildings where such children as are able may go to school. A new assembly hall of some kind would fill all the school needs of the institution. If the General Assembly sees fit to authorize us to carry out this program of recreation halls, we will need $12,500 for Meriden and $10,000 each for Hartford and Norwich. Other of the Meriden Sanatorium needs are $1,500 for outfitting a playground, and $10,000 for the equipment of the new children's building already authorized.

THE NORWICH SANATORIUM.

The Sanatorium at Norwich, the newest in construction and by some of the out-of-the-state experts considered to be the most modern and most attractive tuberculosis sanatorium in this part of the world, still retains its hold on popular favor. As Dr. Hugh B. Campbell is its superintendent and has been its superintendent from the beginning, it is needless to say that to him much of the success of the institution is due. In spite of the fact, already mentioned, that his services as a tuberculosis specialist are in great demand by the hospitals and clinics and private physicians of the eastern part of the state, he continues to have intimate control of every patient in the sanatorium.

The special construction demands of the Norwich Sanatorium for the next two years are not many; $2,500 for enlarging the old farm house in order to better accommodate the help and make it possible to employ as assistant, a married physician; $4,000 for an enlargement of the kitchen with a bake room. The questions of recreation hall and heliotherapy platform we have already discussed.

The Shelton Sanatorium.

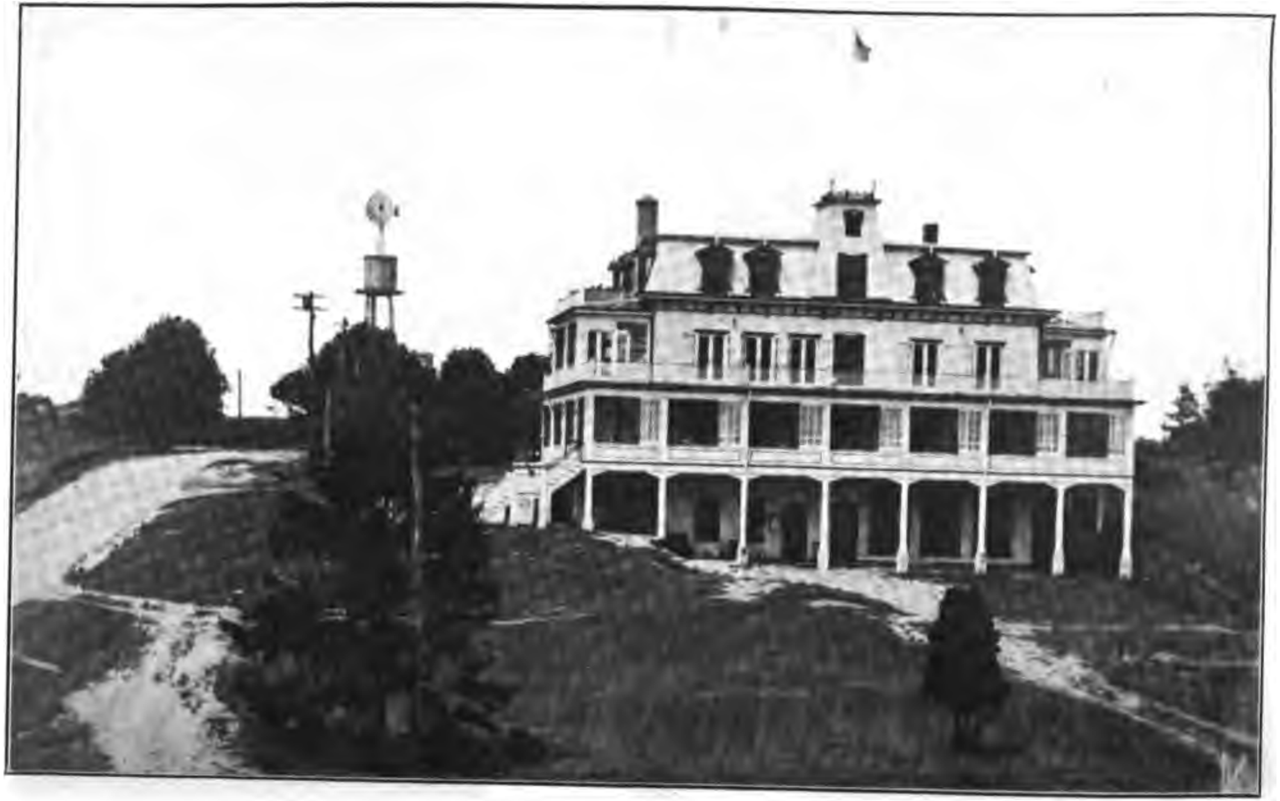
The Shelton Sanatorium, on one of the hills overlooking the Housatonic valley, has, perhaps, the most commanding location of any of the sanatoria and, because of its proximity to several large and growing cities, it is probably destined to become the largest institution of its kind in the state. Dr. Edward J. Lynch continues to be its superintendent. He has been exceptionally successful in interesting the public-spirited and charitable people of Connecticut in the welfare of the institution under his charge. And it has been very comforting to the Commission to see that his skill as a tuberculosis expert receives more and more recognition every year from the medical authorities of Bridgeport and the adjacent towns.

Shelton needs a new garage that will cost $2,300, and a new barn that will cost $6,500. It has a recreation hall, but like the other institutions, it needs a heliotherapy platform at a probable cost of $600.

The Seaside Needs.

The Superintendent of the Seaside, Dr. John F. O'Brien, has had several years of special training and practice in the care and treatment of crippled children. Under his management we expect great things from The Seaside.

For the Seaside we ought to have an appropriation of $15,000 for the erection of a suitable cottage for the superintendent. At present Dr. O'Brien's family of five persons is crowded into the little six-room cottage that was part of our original $12,000 purchase. We have spent several hundred dollars in transforming it from an unplastered, unheated summer house into one in which it is possible to live during the winter; but, of course, it is not satisfactory and it will not be possible to keep as superin-



"THE SEASIDE" BY DAY.

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tendent any physician of the caliber of Dr. O'Brien unless we provide him and his family with a respectable and comfortable home. The small building in which he is now housed will be of the greatest possible service to us as a detention and isolation ward. We need here, also, $20,000 to build quarters for nurses and help. These could be provided by a small building on the site of the present dilapidated barn. For the building of two short stretches of cement roadway, one leading to the office and the other to the kitchen, we will need $3,800.00.

SANATORIA UNDER PRIVATE MANAGEMENT.

There are two tuberculosis sanatoria in the state—Gaylord Farm Sanatorium at Wallingford, and Wildwood Sanatorium at Hartford—not established and not managed by the State. Both these institutions receive substantial assistance from the state—about $5 a week per patient. The former has a capacity of about 130 beds and is under the supervision of a former member of this Commission. It has an enviable record among institutions of this kind and has been of emphatic assistance in the campaign against tuberculosis in this country. Wildwood Sanatorium, with a capacity of about 50 beds, is under the management of the Hartford Hospital and assumes a work which, in our judgment, every leading general hospital in the state should assume. We report both institutions in good condition and well managed.

COMMUNITY SUPPORT.

As we have noted in our previous reports, the support given the work of the Commission by the press of the state and by various organizations and individuals has been emphatic and continuous. By gifts, entertainments and visitation, the sick patients in our institutions have been cheered and helped. In this connection we cannot urge too strongly that all the citizens and taxpayers of the state take time to inform themselves as to just what is done in our various sanatoria. We are frequently reminded that the people in general know little about these institutions which they have all helped to build. Even the physicians of the state are too often ignorant of the work and regulations of the sanatoria. It would, we believe, be of great value to the cause if committees of the State Legislature and individual members would visit all our institutions. We desire to call special attention to the lists of names of the more generous friends of the sanatoria. These lists are printed at the close of this narrative portion of our report.

One of the pleasant experiences of the past two years has been the opportunity of welcoming, at the various sanatoria, the large delegation of officers and prominent members of The Employees' Tuberculosis Relief Association of New Haven, who have paid regular visits to all of the sanatoria, called on their own members who were patients, carefully inspected everything in the buildings and on the grounds and, on their return to New Haven, made detailed and interesting reports to their association. As this association represents about half of the population of New Haven and embraces in its membership many of the ablest men of the state, it isn't necessary to say that we are anxious for its approval and that we listen eagerly to the constructive criticism that it sometimes gives us. We would be proud to have visits from representatives of the other similar organizations of the state.

The Christmas Seals.

In most states, the sale of Christmas Seals has been managed by a voluntary organization called a State Tuberculosis Association. This association usually has a board of directors or an executive committee that appoints somebody as executive secretary. This functionary appoints a staff of clerks and, for the upkeep of his headquarters and for purposes of a central publicity, usually exacts from the local agents throughout the state, that is from the local volunteer organizations who actually sell the seals, a large proportion—twenty to sixty per cent.—of their gross income from the Christmas campaign. Because of the wide range of the functions assigned by statute to the Connecticut State Tuberculosis Commission and the evident intention of the Connecticut Assembly to give the state control of the tuberculosis campaign to the State Tuberculosis Commission, the National Tuberculosis Association six years ago, at a time when the amount of money produced by the Christmas seal sale was very low, asked us to undertake the management of the seal campaign. We complied with this request, took over the control of the few old agencies, established twenty new agencies, and carried on a campaign that in that first year brought Connecticut into the first half a dozen states classified according to per capita receipts. We have bettered our record every year since. Last year in Connecticut there were more than $80,000 worth of these little Christmas tokens sold. This represented a per capita sale of more than six seals. How creditable a result this was may be gathered from the following table:

Year.	*Total Sale.*	*Per Capita Sale.*	*National Standing. (Based on Population).*
1914	$17,353.11	1.556	Third
1915	25,645.32	2.095	Second
1916	32,908.36	2.644	Second
1917	43,602.24	3.446	Second
1918	(Seal sale was abandoned because of numerous war drives. The American Red Cross supplied the fund from its treasury.)		
1919	82,324.94	6.3	Second

According to the terms of our contract with the National Tuberculosis Association, about ten per cent. of the gross income from the sale of Christmas seals was sent to the New York office to reimburse it and the American Red Cross for the expenditures for clerks, postage, printing and publicity. For our expenses in conducting the campaign in Connecticut, in supplying stationery, films, speakers and literature, in some years we have retained 5 per cent. of our agents' income and in some years we have retained nothing. As we explained in last year's report, we succeeded in paying our bills from the surplus of a mail order campaign that we conducted from our office over such distant or thinly populated parts of the state as could not be covered by local agencies. And none of this surplus was used by us until it was first offered for anti-tuberculosis work to the authorities of the towns from which it was derived. The net results of our management of the Christmas Seal campaign were:

A. Our sales of Christmas Seals in Connecticut were among the highest in the country.

B. Our expenses in conducting the Christmas seal sale in Connecticut were altogether the lowest in the country.

C. In no other state in the country did the local agencies have for local use so large a proportion of the funds they raised by the sale of Christmas seals.

There has been in many of the other states so much wasted energy in the attempt to control the tuberculosis situation, that Connecticut's method has attracted considerable attention lately. Some of the authorities hesitate to adopt the Connecticut method because (1) they fear that a State Tuberculosis Commission would become so overburdened with routine duties as to deprive it of the powers of vision and initiative necessary for leadership, and because (2) they fear the public would not give personal and enthusiastic support to a campaign conducted by state officials, no matter how capable they might be. Our experience in Connecticut demonstrates that such fears are groundless. Connecticut's sanatoria continue to be among the best in the country, but no other state has done better work in the establishment of clinics, dispensaries, tuberculosis nursing agencies, expert consultation service, employees' tuberculosis relief associations, nor in the adaptation of tuberculosis measures to new scientific information, nor in efforts to dispel the darkness that still envelops the whole problem of tuberculosis. And as to the fear that the public would not join in a campaign led by state officials, we can only say this:

No private or non-offcial organization in any state has ever had, or could ever have, greater or more spontaneous or more generous and sympathetic support from the general public and from the various civic, religious, fraternal, labor and anti-tuberculosis organizations, than have been given to us for the past ten years. We have not attmepted to interfere with the management of these various betterment organizations, but our suggestions as to the best ways of fighting tuberculosis have been heard and followed with an impulsive and frank loyalty and earnestness that has left us humble as well as grateful.

We would say to the hesitating authorities of other states: Fear not. The Connecticut way is the best way. And in fact the Connecticut method must have a strong appeal to every serious tuberculosis student. In discussing in the July number of the *American Review of Tuberculosis,* the work of the Rockefeller Commission for the Prevention of Tuberculosis in France, Dr. Bernard Langdon Wyatt says:

"The generally accepted principle of centralization of control and de-centralization of operation was adhered to with most satisfying results."

That's it. That's the Connecticut method—"centralization of control and decentralization of operation".

OUR OFFICE STAFF.

This report would not be complete if it did not acknowledge the debt we owe to our office staff who, at all times in the year, but especially in the "rush" times of the year, have given us their heartiest and most enthusiastic support, and have never flinched when called upon to do extra work before or after hours. Much of the success of which we are so proud, and of which we get the credit, would not have been possible without just such loyalty and vigilance and executive ability as were displayed by Miss Cummings, Miss Baird and Mr. Sedgwick.

FRIENDS OF THE STATE TUBERCULOSIS SANATORIA.

HARTFORD.

Mrs. Du Vernitt Butterfield, 122 Garden St., Hartford, Conn.
The Hartford Tuberculosis Society, Hartford, Conn.
Mrs. T. M. Russell, 343 High Street, Middletown, Conn.
Rev. J. Dooley, 157 Hillside Ave., Hartford, Conn.
The Hungarian Ladies' Circle, 182 State Street, Hartford, Conn.
The Goodwin Drug Co., Hartford, Conn.
Mrs. Crowther, 36 Sisson Ave., Hartford, Conn.
The Travelers' Girls' Club, Travelers' Building, Hartford, Conn.
Mrs. Hallenbeck, Chester, Conn.
Mrs. M. K. Samuels, 128 Collins St., Hartford, Conn.
The Ladies' Guild, Trinity Church, Hartford, Conn.
Mrs. Edwin Strong, Hartford, Conn.
The Hartford Times, Hartford, Conn.
Mr. James Clancy, Palace Theatre, Hartford, Conn.
Mr. Jones, Secretary Musicians' Union, Palace Theatre Orchestra, Hartford, Conn.
St. Anne's Guild, New Haven, Conn.
Mrs. Mooney, Deep Wood, West Hartford, Conn.
Rev. Paul H. Barber, 198 Farmington Ave., Hartford, Conn.
The American Red Cross, Bureau of Supplies, 100 Washington St., Boston, Mass.
Mrs. F. E. Lewis, Ridgefield, Conn.
Miss Helen Taksar, 700 Grandview Terrace, Hartford, Conn.
Miss Sara A. Carroll, Visiting Nurses' Association, New Haven, Conn.
Miss May O'Gorman, New Haven, Conn.
Miss Josephine Smith, New Haven, Conn.
Y. W. C. A., Hartford, Conn.
Hartford Tuberculosis Fund, Hartford, Conn.
St. Vincent DePaul Society, Hartford, Conn.
Rev. William F. O'Dell, Elmwood, Conn.
Rev. Peter Dolan, 157 Hillside Ave., Hartford, Conn.

MERIDEN.

Hon. E. Kent Hubbard, Middletwon, $5.00.
Miss Anna Sands, Meriden, $5.00.
Hon. John Buckley, Hartford.
Dr. S. J. Maher, New Haven, candy and magazines.
Miss Indiana Thomas, Meriden, Victrola records.
Girls' Friendly Society, Meriden, baskets, candy, fruit and cut flowers.
Miss Hall, Meriden, kindergarten materials, magazines.
Tuberculosis League of Hartford, $100 for entertainment and building stage.
Central Labor Union, Meriden, $300 Amusement Fund.
Central Labor Union, Meriden, organization of city bands and orchestra and other amusement companies for entertainment.

St. Ann's Guild, New Haven, Christmas stockings for children.

Mrs. George Wilcox, Meriden, cut flowers.

Mrs. George Curtis, Meriden, candy, cigarettes and toys.

Mr. J. E. Ritchie, New Haven, books of fiction.

Mr. J. Sternberg, Meriden, magazines and cut flowers.

Women's Temperance Union, Meriden, cut flowers.

New Haven Employees' Relief Association, magazines, books, materials for sewing class.

Meriden City Band, P. Azzolina, director of concerts.

Meriden Military Band, P. Russette, director of concerts.

Royal Arcanum Minstrels, entertainments.

All Saints' Church, Meriden, potted flowers.

E. W. Simmons, New Haven, through Shartenburg & Robinson, two sewing machines.

Jas. A. McNamara, New Haven, $5.00.

Wm. McGowan, Waterbury, $10.00.

Clergymen on Call.

Rev. John Lynch, Rev. Patrick McCarthy, Rev. Thos. E. McGarry, Rev. Thos. Martin, Rev. D. Ricci, Rev. A. Van Oppen, Rev. N. F. Schneider, Rev. John Ceppa, Rev. George Bartalewski, Rev. Oscar Clauson, Rev. S. F. Glaser, Rev. Paul Kirsh, Rev. A. J. Lord, Rev. Victor G. Mills, Rev. A. T. Randall, Rev. D. R. Johns, Rev. F. S. Lippit, Rev. Fred Saunders, Rev. P. Saurusitis.

Norwich.

A fund of $524.70 collected at Christmas time, 1918, by Mrs. F. A. Byrnes and Miss Mary A. Richards of Norwich for the benefit of the patients at Christmas and the holidays throughout the year.

A fund of $1,041.72 collected at Christmas time, 1919, by the ladies mentioned above for the same purpose.

Proceeds of about $50 from the sale of chocolate by Mrs. M. F. Dougherty of Norwich for the benefit of the patients.

Proceeds of about $150 from a dance and whist given by White Cross Council, No. 13, Knights of Columbus, Norwich, for the benefit of the patients.

Proceeds of about $55 from a dance given by the clerks of Peterson's Candy Shop, Norwich, to be applied toward the purchase of an X-ray machine.

The Evening Record.
Utley & Jones.
Del Hoff Hotel.
James C. MacPherson.
Chas. Slosberg & Son.
The Manhattan Co.
Woolworth & Co.
Baird Tire & Supply Co.
J. H. Perkins.
Hourigan Bros.
Providence Bakery.
Ring & Sisk.
Disco Bros.
J. P. Barstow & Co.
Church & Allen.
Joseph Connor & Sons.
City Lunch & Martin House.
Shea & Burke.
Geo. A. Keppler.
Rumford & Co.
Mrs. Edwin Fay.
J. A. Ferguson.
The Boston Cafe.
Geo. P. Madden.
Hagberg & Son.

A fund of $425.10 collected from ex-patients and friends for a moving picture machine.

A moving picture machine, Victrola and about a hundred records from the Committee on War Activities of the Knights of Columbus.

Loan of moving picture films weekly by Mr. Al Craig, manager of the Davis Theatre, Norwich.

Library of about three hundred books of late Nellie Carpenter, Putnam.

Several concerts by the Lotus Quartet, Boston, and the Bass Clef Club, Norwich.

The Cranston Co.
Otis Library.
St. Rose's Guild, New Haven.
Employees' Tuberculosis Relief League, New Haven.
Geduldig's Greenhouses.
Girls' Community Club.
Pasnik Co.
The Hamilton Co.
Peterson's, Inc.
The Jordan Co.
The Mohican Co.
The Geo. Kies Co.
Murphy and McGarry.
The Cosgrove Co.
Reid & Hughes Co.
The Marlin-Rockwell Corp.
Norwich Chapter, American Red Cross.
John F. Tompkins.
The Porteous & Mitchell Co.
Lee & Osgood Co.
The Bulletin Co.
The Bliss Co.
Troy Steam Laundry.
Preston Bros.
Frisbie & McCormick.
Bishop, Bidwell & Co.
Stoddard, Gilbert & Co.
Peck, McWilliams & Co.
Cummings and Ring.
The Swift Co.
The Plaut-Cadden Co.
Armour & Co.
James J. Drudy.
Lawton Mills.
Direct Importing Co.
Loyal Circle of King's Daughters.
Norwich Electric Co.
Max Gordon Co.
Smith's Pharmacy, Inc.
The M. C. Swan Co.
A. G. C. Club, Jewett City.
The J. C. Worth Co.
The Talking Machine Shop.
The K. B. Club, Jewett City.
Enphernian Circle of King's Daughters.
B. Natural Musical Club.
J. M. Young & Son.
Friedburg & Son.
Eaton-Chase Co.
Don Houghton.
P. J. Morley.
P. B. Storage Battery & Welding Co.
Wm. Friswell Co.
Norwich Brick Co.
M. Sussman Silverberg & Son.
Schwartz Bros.
The Barstow Co.
Mara & Eggleton.
St. Agnes' Guild of Christ Church.
Smith, the Florist.
Casper Graff.
St. Andrew Altar Society.
The Tennyson Club.
Sellas Spa.
Wauregan Hotel.
Rathbon's Drug Store.
The Brockton Shoe Co.
C. Bell.
W. R. Perkins.
Girls of Park Congregational Church.
Mrs. J. P. Casey.
Mrs. J. N. Rosenberg.
Rev. Richard Graham.
Rev. J. P. Broderick.
Rev. P. J. Cuny.
Rev. Miles Galvin.
Rev. Daniel F. Sullivan.
Rev. Alexander Abbott.
Rev. M. McLean Goldie.
Rev. I. V. Macielewski.
Miss Anna Hield, New London.

SHELTON.

Miscellaneous.

Mrs. Franklyn Farrell, Ansonia, Conn., ice cream, candy, Easter cards, 2 crates oranges, 2 crates grapes, 2 cases jam.

Miss M. E. Lathrop, Derby, Conn., candy.

Mrs. Geo. C. Bryant, Ansonia, Conn., cornucopias.

Ladies of St. Ann's Guild, New Haven, Conn., Christmas stockings.

Mr. and Mrs. Comley, Bridgeport, Conn., phonograph records.

Rev. John Connors, New Haven, Conn., phonograph records.

Ansonia Lodge of Elks, Ansonia, Conn., Victrola and records.

Ansonia Lodge of Elks, Ansonia, Conn., moving picture machine.

Mrs. John B. Russ, Shelton, Conn., phonograph records.

Knights of Columbus, Shelton, Conn., moving picture machine.

Mrs. Richard H. Hubbell, Shelton, Conn., sewing machine.

Hubbell Brothers, Derby, Conn., war photographs.

Mr. Becker, New Milford, Conn., flowers.

Red Cross, Ridgefield Branch, Ridgefield, Conn., 14 rolls gauze, 2 bolts sheeting, 49 rolls medicated cotton, 30 rolls tape, 5 rolls cotton batting.

Mrs. Catherine Cook, Shelton, Conn., flowers.

Ladies' Refreshment Committee for Soldiers' Night, Shelton, Conn., 18 loaves of cake.

Red Cross, Derby and Shelton Branch, Derby, Conn., piano, cabinet for surgical dressings.

American Red Cross, Bureau of Supplies, Boston, Mass., 3 cases gauze, 3 cases surgical dressings.

Webster Hose Co., Ansonia, Conn., 3 months' moving picture film service.

Mr. Jeremiah Flanagan, Ansonia, Conn., 2 crates oranges.

Mrs. C. J. Florin, Ansonia, Conn., flowers.

Dr. F. J. Peck, Ansonia, Conn., flowers.

Mr. Thos. H. Kneen, Ansonia, Conn., flowers.

Mr. Archibald Davidson, Ansonia, Conn., flowers.

Mrs. W. J. Chegwidden, Derby, Conn., piano.

Charter Hose Co., Ansonia, Conn., 3 months' moving picture film service.

Banquet Committee for Armistice Day, Derby, Conn., refreshments.

Mrs. Fred Warr, Ansonia, Conn., piano.

A friend, phonograph records.

Miss Johnson, New Haven, Conn., phonograph records.

Mrs. Anne E. Bassett, Ansonia, Conn., candy and Christmas decorations.

Mrs. Rutherford Trowbridge, New Haven, Conn., pop-corn balls.

St. Ann's Guild, New Haven, Conn., box of Christmas gifts.

Mrs. Elsie Scovill, Washington, D. C., Victrola and records.

Mrs. R. H. Hubbell, Shelton, Conn., Christmas decorations and records.

Shelton Welfare Committee, Shelton, Conn., refreshments.

Salvation Army, Ansonia Branch, Ansonia, Conn., refreshments.

Eastern Star Lodge, Derby, Conn., refreshments.

Scovill Mfg. Co., Waterbury, Conn., 1 box plants and stand.

Friend A. Russ' Fund and friends, Shelton, Conn., X-ray, $5,000.00.

ACKNOWLEDGEMENTS.

Books and Magazines.

Mrs. S. A. Warner, Ridgefiled, Conn.
Mrs. Henry Kaiser, Ansonia, Conn.
Mrs. H. Keeler, Shelton, Conn.
Mrs. E. S. Sperry, Derby, Conn.
Mrs. R. S. Gardner, Derby, Conn.
Hubbell Brothers, Derby, Conn.
Miss Emma Thorpe, Shelton, Conn.
Miss Annie Larkin, Ansonia, Conn.
Mrs. Anne E. Basett, Ansonia, Conn.
Mr. John H. Hine, Ansonia, Conn.
Miss Dorothy Bryant, Ansonia, Conn.
Mrs. Franklyn Farrell, Ansonia, Conn.
Mrs. W. E. Clark, Ansonia, Conn.
Employees' Tuberculosis Relief Association, New Haven, Conn.
Mrs. John B. Russ, Shelton, Conn.
Plumb Memorial Library, Shelton, Conn.
Mrs. Mary Gardner, Derby, Conn.
Miss M. E. Lathrop, Derby, Conn.
Salvation Army, Ansonia Branch, Ansonia, Conn.
Mrs. Edson L. Bryant, Ansonia, Conn.
Mrs. D. E. Brinsmade, Shelton, Conn.
Miss N. A. O'Brien, Waterbury, Conn.
Scovill Manufacturing Company, Waterbury, Conn.
Mrs. Emma Mock, Ansonia, Conn.
Mrs. W. A. Tolles, Ansonia, Conn.

Clothing.

The Needlework Guild of America, Bridgeport, Conn.
Mrs C. H. Cook, Shelton, Conn.
Mr. and Mrs. Comley, Bridgeport, Conn.
Miss Dorothy Bryant, Ansonia, Conn.
Miss Curtiss, Shelton, Conn.
Shelton Branch of Red Cross, Shelton, Conn.
Women's Relief Corps, Derby, Conn.
Mrs. C. J. Florin, Ansonia, Conn.
Derby Branch of Red Cross, Derby, Conn.
Mrs. Frederick S. Seeley, Bridgeport, Conn.
Mrs. Edson L. Bryant, Ansonia, Conn.
Mrs. Anne E. Bassett, Ansonia, Conn.
Miss Cora M. Bennett, Shelton, Conn.
Mrs. V. H. Perry, Shelton, Conn.
Mrs. A. M. Marsh, Southport, Conn.

Entertainment.

March 10, 1919, Minstrel Show, Chorus of 40 and orchestra, Ansonia Lodge of Elks, Ansonia, Conn.
April 11, 1919, Moving pictures and orchestra, Ansonia Lodge of Elks, Ansonia, Conn.
May 16, 1919, Minstrel Show, Ansonia Lodge of Elks, Ansonia, Conn.
December 1, 1919, Minstrel Show by M. M. D. A. O. F., Ansonia, Conn.
January 7, 1920, Concert by Mrs. J. B. Russ, Mr. Pidge, Mrs. Oliver Lewis, Mrs. Rosetta Proffitt, Shelton, Conn.
January 9, 1920, Minstrel Show by Farrell Foundry Employees, Ansonia, Conn.

May 23, 1919, Entertainment by Mrs. John B. Russ and Community Club Girls, Shelton, Conn.

June 6, 1919, Concert by Lotus Quartette, Boston, Mass.

August 22, 1919, Minstrel Show, Ansonia Lodge of Eagles, Ansonia, Conn.

September 30, 1919, Band Concert by Ansonia Band, with Mrs. William Howard, soloist, Ansonia, Conn.

November 20 1919, Concert by Ida E. Hipelius, Edna Bears and Joseph Hipelius, New Haven, Conn.

January 26, 1920, Concert by Van Slyke's Orchestra, Bridgeport, Conn.

May 21, 1920, Concert by Bridgeport Singing Orchestra, Bridgeport, Conn.

June 1 1920, Concert by Miss Ida E. Hipelius and Miss Edna Bears, New Haven, Conn.

June 24, 1920, Moving Picture Entertainment by Maurice J. Culhane, Shelton, Conn.

THE SEASIDE.

Mrs. Alden, New Haven, Conn.
Miss Roberta Allen, New Haven, Conn.
Mr. and Mrs. W. S. Allis, Norwich, Conn.
Mr. and Mrs. Anderson, Passaic, N. J.
Mrs. Rosemary Anderson, New London, Conn.
Mrs. A. F. Bishop, Niantic, Conn.
Mrs. Bradley, New Haven, Conn.
Mrs. Britt, New Haven, Conn.
Mrs. Broadhurst, New Haven, Conn.
Mrs. Simeon Brooks, Chester, Conn.
Dr. Hugh B. Campbell, Norwich, Conn.
Miss Agnes Champion, Niantic, Conn.
Miss Tillie Cassel, Waterbury, Conn.
Mrs. Andrew Champion, Flanders, Conn.
Mrs. Etta S. Chapman, Flanders, Conn.
Mrs. M. E. Chapman, Flanders, Conn.
Mrs. George Clark, Niantic, Conn.
Mrs. Sarah E. Colgan, The Seaside Sanatorium.
Mr. W. D. E. Colgan, Hartford, Conn.
Mrs. Coroley, Crescent Beach, Conn.
Miss Gregory, New Haven, Conn.
Mr. and Mrs. Harrington, Southbridge, Mass.
Mr. Johnson, Danielson, Conn.
Mrs. Emma Jones, Niantic, Conn.
Mrs. Mary Kelly, Waterbury, Conn.
Mrs. J. W. Knox, Hartford, Conn.
Miss Louise Long, Niantic, Conn.
Mrs. J. J. McPartland, New Haven, Conn.
Mrs. Martel, Springfield, Mass.
Mrs. Oscar Maurer, New Haven, Conn.
Miss Virginia Merritt, Crescent Beach, Conn.
New Haven Sunshine Society, New Haven, Conn.
Niantic Sunshine Society, Niantic, Conn.
Mr. P. J. O'Rielly, Bridgeport Conn.
Mr. William Pathe, Scranton, Pa.
Mrs. Louise Perkins, Waterford, Conn.
Mrs. Poor, New London, Conn.
Miss Kathleen Reen, Hartford Conn.
Mrs. E. L. Roberts, Waterford Conn.
St. John's Auxiliary, Niantic, Conn.
Mrs. Minnie Samuels, Hartford Conn.
Miss Ruth Samuels, Hartford Conn.

Mrs. Marion R. Davis, Niantic, Conn.
Miss Nana Davis, Niantic, Conn.
Miss Nora Doohan, Hartford, Conn.
Mr. Homer Dorman, Niantic, Conn.
Mrs. William Egan, Hartford, Conn.
Mrs. Eldredge, Niantic, Conn.
Mrs. J. E. Erckman, Portsmouth, N. H.
Mrs. E. R. Faucher, New Haven, Conn.
Miss L. A. French, Boonton, N. J.
Mrs. Getchel, Niantic, Conn.
Miss Katherine Gilbert, New Haven, Conn.
Miss Margaret Gillis, Waterbury, Conn.
Mrs. D. C. Saunders, New Haven, Conn.
Miss Gladys Scoville, New London, Conn.
Mrs. Sewell, Passaic, N. J.
Mrs. F. Smith, Flanders, Conn.
Mrs. Louise M. Stevens, Niantic, Conn.
Miss Taber, Waterbury, Conn.
Miss Thayer, New York City.
Mrs. Thomas, Niantic, Conn.
Mrs. Hymen Weiner, New Britain, Conn.
Dr. Thomas E. Weldon, South Manchester, Conn.
Dr. Frank E. Wilson, New London, Conn.
Dr. Oliver E. Winship, New London, Conn.

One of our pleasant duties in this report is to acknowledge the receipt of a few entirely unsolicited private contributions to a fund for the benefit of our little patients at the Seaside. These friends of the Seaside were:

Mrs. J. C. Knowlton. New Haven, Conn.
Mr. Luke A. Daniels, New Haven, Conn.
Mrs. M. B. Williams, Hartford, Conn.
New Haven Branch, The National Association for the Advancement of Colored People.
Mrs. Jonathan Godfrey, Bridgeport, Conn.

ADDITIONAL DONORS TO THE STATE TUBERCULOSIS COMMISSION.

Mrs. Henry L. Wade, Middlebury.
Mr. A. Ware Merriam, Farmington.
Mr. Angus Park, Hanover.
Dr. Fred Sumner Smith, Chester.
Mr. Whitney Palache, Farmington.
Miss Anne M. Hyde, Middle Haddam.
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Standard Card .Clothing Co., Stafford.
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Mr. J. Ralph Howe, Uncasville.
The Reverend Kenneth Mackenzie, Westport.
Cromwell Hall, Inc., Cromwell.
Mr. F. D. Leach, Windsor Locks.
The Ellison Construction Co., Deep River.
Mr. George Roberts, Twin Lakes.
The Eastern Lounge Co., New Milford.
The Tiley Pratt Co.. Essex.
Mr. Fred H. Thrall, Windsor.
Mr. Julius Day, Madison.
Mr. Wm. C. Skinner, Jr., Farmington.
Mrs. R. C. Williams, Avon.
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Mr. Robert L. Coe, Middlebury.
Mr. H. K. Welch, East River.
Miss Elizabeth Cockroft, Saugatuck.
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Mr. Samuel P. Williams, Madison.
Nabyan Woolen Co., Stafford.
Dr. C. H. Peck, Newtown.
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Mr .Samuel J. Miller, Cannondale.
Mr. Fred Wiley, Stafford.
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Morgan & Dickinson, Windsor.
Mr. John F. Maizon, South Windsor.
Mr. S. E. Gage, West Morris.
Mr. F. J. Hallenback, Chester.
Mr. Everett T. House, Farmington.
Pratt Read & Co., Deep River.

SANATORIUM EMPLOYEES.

Incompliance with Section 185 of the General Statutes, we append the following list of employees at the various sanatoria, whose compensation is not less than $450.00 per annum.

MERIDEN SANATORIUM EMPLOYEES.

Superintendent, $2,000.00 with board for self and family.
Resident physician, $1,200.00 with board for self and family.
Head Nurse, $1,140.00 with board.
Steward $1,080.00 with board.
Four Nurses, $780.00 with board.
Three Nurses, $720.00 with board.

One Nurse, $600.00 with board.
Bookkeeper, $720 with board.
Teacher, $780.00 with board.
Chef, $1,500.00 with board.
Pastry Cook, $660.00 with board.
Watchman, $660.00 with board.
Engineer, $780.00 with board.
Carpenter, $1,976.00 with board.
Chauffeur, $720.00 with board.
Painter, $660.00 with board.
Yardman, $660.00 with board.
Maid, $540.00 with board.
Kitchen man, $480.00 with board.
Laborer, $480.00 with board.

Shelton Sanatorium Employees.

Superintendent, $2,700.00 with board for self and family.
Resident Physician, $1,200.00 with board for self and family.
Head Nurse, $1,080 with board.
Three nurses, $900.00 with board.
Two nurses, $780.00 with board.
Two nurses, $720.00 with board.
One nurse, $660.00 with board.
Secretary, $900.00 with board.
Stenographer, $780.00 without board.
Housekeeper, $900.00 with board.
Chef, $1,480.00 with board.
Second cook, $600.00 with board.
Infirmary cook, $540.00 with board.
Engineer, $1,020.00 with board.
Watchman, $720.00 with board.
Fireman, $720.00 with board.
Farmer, $1,200.00 with board.
Two farm hands, $540.00 with board.
One farm hand, $480.00 with board.
Poultry man, $720.00 with board.
Carpenter, $540.00 with board.
Orderly, $600.00 with board.
Four orderlies, $480.00 with board.
Maid, $480.00 with board.
Kitchen man, $540.00 with board.

Kitchen man, $480.00 with board.
Storeroom man, $540.00 with board.
Driver, $480.00 with board.

Hartford Sanatorium Employees.

Superintendent, $3,000.00 with board for self and family.
Resident physician, $1,800.00 with board.
Head nurse, $1,080.00 with board.
Housekeeper, $900.00 with board.
Bookkeeper, $900.00 with board.
Teacher, $720.00 with board.
Stenographer, $540.00 with board.
Seven nurses, $660.00 with board.
Nurse, $900.00 with board.
Three nurses, $720.00 with board.
Nurse, $600.00 with board.
Chef, $1,200.00 with board.
Pastry cook, $780.00 with board.
Second cook, $780.00 with board.
Storekeeper, $900.00 with board.
Two chauffeurs, $780.00 with board.
Driver, $660.00 with board.
Watchman, $660.00 with board.
Fireman, $660.00 with board.
Waiter, $660.00 with board.
Waiter, $600.00 with board.
Waitress, $480.00 with board.
Two maids, $480.00 with board.
Kitchen man, $600.00 with board.
Kitchen man, $540.00 with board.
Three orderlies, $480.00 with board.
Farmer, $1,480.00 with board.
Teamster, $720.00 with board.
Laborer, $720.00 with board.
Laborer, $660.00 with board.
Laborer, $480.00 with board.
Laundry foreman, $2,600.00 without board.
Laundry fireman, $1,300.00 without board.
Eight laundresses, $15.00 per week without board.
Laundress $480.00 with board.

Norwich Sanatorium Employees.

Superintendent, $3,000.00 with board for self and family.
Resident physician, $1,200 with board.
Secretary, $840.00 with board.
Stenographer, $480.00 with board.
Two nurses, $840.00 with board.
Two nurses, $780.00 with board.
Eight nurses, $720.00 with board.
Attendant, $480.00 with board.
Barber, $720.00 without board.
Housekeeper, $840.00 with board.
Chef, $1,140.00 with board.
Kitchen man, $660.00 with board.
Assistant chef, $780.00 with board.
Waiter, $480.00 with board.
Maid, $480.00 with board.
Farmer, $1,548.00 with part maintenance.
Carpenter, $840.00 with board.
Laborer, $720.00 with board.
Storekeeper, $900.00 with board.
Engineer, $960.00 with board.
Baker, $26.00 per week without board.
Fireman, $25.00 per week with board.
Watchman, $25.00 per week with board.
Three laborers, $25.00 per week with board.
Teamster, $27.00 per week with board.
Maid, $10.00 per week with board.
Laborer, $24.50 without board.

The Seaside Employees.

Superintendent, $2,500.00 with board for self and family.
Head nurse, $1,080.00 with board.
Nurse, $720.00 with board.
Nurse, $840.00 with board.
Three nurses, $600.00 with board.
Bookkeeper, $840.00 with board.
Cook, $840.00 with board.
Fireman, $1,080 with board.
Watchman, $720.00 with board.
Orderly, $480.00 with board.

Financial Report of the Meriden State Sanatorium, Meriden, Conn.

DR. COLE B. GIBSON	*Superintendent*
DR. WILLIAM CARROLL	*Assistant Physician*
MISS MAUD M. WHITE	*Head Nurse*
MRS. ETHEL M. BAVIER	*Secretary*
EDWARD F. TRACY	*Steward*

REPORT FOR THE YEARS ENDING JUNE 30, 1919, AND FOR JUNE 30, 1920.

Institution Receipts:	Years 1918-19	1919-20	
Board of Patients:			
Towns and cities	$10,490 93	$13,590 83	
Associations	3,177 29	5,247 79	
Individuals	2,299 90	2,900 94	
	$15,968 12	$21,739 56	
Total receipts for board, October 1, 1919 to June 30, 1920			$37,707 68
Miscellaneous receipts:			
Clothing	$209 80	$722 47	
Telephone and stamps	6 27	18 12	
Sales of grease	64 41	74 85	
Miscellaneous sales	494 76	799 38	
	$775 24	$1,614 82	
Total miscellaneous receipts for board, October 1, 1919 to June 30, 1920			$2,390 06
To bills of institution paid by State Tuberculosis Commission:			
Construction		$55 62	
Equipment	$2,665 56	560 00	
Maintenance	82,297 94	95,512 79	
	$84,963 50	$96,128 41	
Total of all bills paid by State Tuberculosis Commission October 1, 1918-June 30, 1920			$181,091 91
Cash book balance October 1, 1918			704 42
Total receipts from all sources			$221,894 07

PAYMENTS.

	Years 1918-19.	1919-20.	
To Secretary of State Tuberculosis Commission	$15,796 04	$20,640 58	$36,346 62
Sundries Account:			
Miscellaneous	$1,164 80	$619 30	
Refunds	242 12	196 63	
Clothing	209 80	722 47	
	$1,616 72	$1,538 40	$3,155 12

Bills paid by check of State Tuberculosis Commission	$84,963 50	$96,128 41	$181,091 91
Cash book balance July 1, 1920			1,300 42
Total			221,894 07

Resources and Liabilities.

Resources.

	Years 1918-1919	1919-1920	
Cash on hand and in bank	$627 39	$1,300 42	
Bills due on patients' board:			
Towns and cities	1,524 15	728 42	
Associations	356 09	91 60	
Individuals	253 44		
	$2,761 07	$2,120 44	
Total			$4,881 51

Liabilities.

Due State Tuberculosis Commission from institution as per resources	$4,881 51

Analysis of Expenses.

Construction account:			
Additional infirmary bed accommodations	$55 62		
Total			$55 62
Equipment account:			
Dental equipment		$375 00	
Miscellaneous equipment	$2,665 56	185 00	
Total			$3,325 56

Maintenance.

	Years 1918-1919	1919-1920	
Salaries, wages and labor:			
General administration and office	$8,231 46	$12,092 99	
Medical	6,902 22	9,938 11	
Farm, stable and grounds	3,820 49	6,921 41	
	$18,954 17	$28,952 51	
Total			$47,906 68
Food:			
Meat	$9,136 09	$13,897 60	
Eggs	1,864 20	3,041 70	
Butter	2,496 78	2,832 45	
Milk	6,385 90	10,059 39	
Fish	658 97	880 13	
Flour	1,001 80	3,450 51	
Sugar	655 70	854 54	

Vegetables	1,096 70	836 52	
Fruit	153 35	1,805 78	
Canned goods	4,511 87	102 68	
Tea and Coffee	603 57	600 10	
Miscellaneous	2,355 27	3,528 21	
	$30,920 20	$41,889 61	
Total			$72,809 81
Light, heat and power:			
Coal	$8,719 92	$1,554 33	
Electric light	1,374 05	2,054 29	
Gasoline, oil and wood	606 86	58 33	
Gas	760 38	1,439 06	
Pump engine repairs			
Electric power	416 73	434 94	
Sundries		34 11	
	$11,877 94	$5,575 06	
Total			$17,453 00
Farm, stable and grounds:			
Carriage and harness repairs	$93 22	$38 60	
Horses	361 02		
Automobiles: repair and supplies	687 31	4,483 82	
Sundries	168 52	556 11	
	$1,310 07	$5,078 53	
Total			$6,388 60
Repairs to buildings:			
Lumber, etc.	$1,930 18	$204 94	
Plumbing	1,398 64	236 76	
Grounds		60 24	
Sterilizer			
Refrigerating plant	241 43	160 72	
Painting	617 49	277 00	
Sundries		242 74	
	$4,187 74	$1,182 40	
Total			$5,370 14
Repairs and replacements of equipment:			
Repairs to fixtures	$111 37	$651 45	
Furniture	103 70	1,176 56	
Bedding and linen	2,616 01	309 00	
Crockery and silverware	542 18	52 22	
Miscellaneous	268 81	410 07	
	$3,642 07	$2,599 30	
Total			$6,241 37

Miscellaneous:			
Telephone and telegraph	$501 00	$544 40	
Printing and stationery	84 84	38 23	
Transportation	236 53	296 24	
Laundry	2,937 27	3,726 17	
Insurance	554 05	1,475 44	
Miscellaneous office account	790 28	301 49	
Housekeeping supplies	1,159 45	161 46	
Medicines and hospital supplies	3,761 69	2,165 48	
Water	781 59	863 22	
Sundries	61 07	79 54	
Sewer	155 34		
School supplies	349 39	21 15	
Dentistry and other hospital	33 25	172 64	
Clothing and materials		389 92	
	$11,405 75	$10,235 38	
Total			$21,641 13
Total maintenance			$177,810 73

MAINTENANCE RESOURCES.

	Years 1918-1919	1919-1920
Goods on hand:		
Fuel	$1,600 60	$1,607 40
Stockroom	3,464 26	5,425 22
Drugs	525 00	1,043 95
	$5,589 86	$8,076 57

RECAPITULATION AND PER CAPITA.

	Oct. 1, 1918	July 1, 1919	
Stock on hand	$6,500 45	$5,589 86	
Total maintenance	82,297 94	95,027 13	
	$88,798 39	$100,616 99	
Stock on hand	5,589 86	8,076 57	
	$83,208 53	$92,540 42	
Actual maintenance, total			$175,748 95
Total number hospital days	27,117	38,515	
Cost per patient per day	$3.068	$2.426	
Cost per patient per week	$21.476	$16.982	
Average per week for two years			19,229

VALUATIONS.

Thirty-one and one-quarter acres of land	6,755 00
Infirmary building with connecting passageway	33,000 00
Two-story, thirty-two bed shack	10,400 00
Dining hall	11,000 00

One-story twenty-four-bed shack	15,800 00
Nurses' home	31,000 00
Superintendent's cottage	5,800 00
Store room	2,000 00
Barn	3,500 00
Shed	550 00
Water tank	1,390 00
Pump house	721 41
Wagons and carriages	75 00
Motor trucks	1,986 70
Passenger automobile	1,388 00
Hose	75 00
Beds and bedding, etc.	8,084 97
Carpets, rugs, etc.	740 03
Crockery, glassware, cutlery, etc.	2,333 47
Dry goods and small wares	784 92
Fire hose and extinguisher (apparatus and alarm)	4,633 50
Kitchen and household wares	3,146 10
Table linen, napkins, etc.	1,134 50
Merchandise on hand	5,425 22
Furniture and household supplies	26,589 77
Coal	1,400 00
Oil	52 00
Steam cooking apparatus	991 00
Steam tables	357 50
Meat grinder	156 75
Laboratory	285 65
Incinerator	1,735 00
	$183,291 59

Financial Report of the State Tuberculosis Sanatorium at Shelton.

DR. EDWARD J. LYNCH	*Superintendent*
DR. HENRY J. SCHROEDER	*Resident Physician*
MISS CATHERINE R. KESSACK	*Head Nurse*
RALPH B. ROGERS	*Secretary*
MISS EMMA L. CLAUBERG	*Stenographer*
MRS. HILDA A. GORDON	*Housekeeper*
CARL O. H. JOHNSON	*Engineer*
WILLIAM L. BEMONT	*Farmer*

REPORT FOR YEARS ENDING JUNE 30, 1919, AND JUNE 30, 1920.

CASH ACCOUNT.

Institution Receipts:	1918-1919	1919-1920	
Board of patients:			
Town and cities	$9,718 88	$10,849 74	
Associations	4,369 57	8,478 68	
Individual patients	8,397 40	10,858 37	
	$22,485 85	$30,186 79	
Total receipts for board October 1st, 1918-June 30, 1920			$52,672 64

Miscellaneous receipts:	1918-1919	1919-1920	
Miscellaneous sales	$16 98	$995 37	
Total miscellaneous sales October 1st, 1918-June 30, 1920			$1,012 35

To bills of institution paid by State Tuberculosis Commission:

	1918-1919	1919-1920
Construction	$6,710 98	$1,767 00
Maintenance	92,002 47	127,238 09
Equipment	12,780 47	1,185 00
	$111,493 92	$130,189 46

Total of all bills paid by State Tuberculosis Commission, October 1st, 1918–June 30, 1920	$241,683 38
Received on outstanding accounts	2,000 77
Total receipts from all sources	$297,369 77
Cash on hand October 1st, 1918	1,012 06
Grand total of all receipts	$298,381 83

PAYMENTS.

	1918-1919	1919-1920
To Secretary of State Tuberculosis Commission, patients' board	$23,587 80	$30.212 11

To Secretary State Tuberculosis Commission, miscellaneous account	16 98	995 37	
To refunds, patients' board	638 56	526 94	
Outstanding accounts, checks not received from Secretary		220 06	
Bills paid by checks of State Tuberculosis Commission	111,493 92	130,189 46	
Cash book balance July 1, 1920		500 00	
	$135,737 26	$162,644 57	
Total expenditures October 1st, 1918-June 30, 1920			$298,381 83

RESOURCES AND LIABILITIES.

Resources.

Cash on hand and in bank July 1st, 1920		$500 00
Accounts receivable:		
Towns-cities	$2,086 90	
Associations	966 26	
	$3,053 16	
Less advance payment on Patients' board	616 34	
		$2,436 82
Office account (not received from Secretary)		220 06
		$3,156 88

Liabilities.

Due State Tuberculosis Commission from institution as per resources	$3,156 88

ANALYSIS OF EXPENSES.

1918-1919.

Construction:		
Incinerator	$52 84	
Infirmary	1,213 14	
Alteration of shacks	745 00	
Sleeping porch	3,000 00	
Water supply	1,700 00	
Total		$6,710 98
Equipment (infirmary):		
Furniture	134 90	
Dishes	75 50	
Hospital supplies	214 43	
Linoleum	86 13	
Bedding	63 38	
Total		$574 34

Equipment (miscellaneous):		
Fire protection	$6,234 07	
Water supply	1,507 43	
Bedding	945 44	
Beds	167 00	
Pool table	31 02	
Hot water heater	175 00	
Electric fixtures	146 00	
Furniture	1,054 05	
Plumbing	390 00	
Electric food cars	337 50	
Screens	963 77	
New nurses' home	254 65	
Total		$12,206 13

MAINTENANCE.

1918-1919.

Salaries, wages and labor:		
General, administration and office	$7,393 84	
Medical services	8,960 11	
Farm, stable and grounds	3,383 42	
Total		$19,737 37
Food:		
Meat	$7,642 11	
Eggs	1,069 80	
Butter	2,281 18	
Milk	9,278 80	
Fish	820 86	
Flour	1,403 28	
Sugar	780 16	
Vegetables	414 83	
Fruit	458 74	
Canned goods	4,532 11	
Tea and coffee	581 93	
Miscellaneous	1,958 26	
Total		$31,222 06
Light, heat and power:		
Coal	12,642 41	
Electric light	1,323 85	
Pump and engine repairs	132 96	
Electric power	530 92	
Refrigerator	73 25	
Total		$14,703 39

Farm, stable and grounds:			
Poultry	$1,099 30		
Carriage and harness repairs	12 35		
Horses	389 00		
Farming tools	74 88		
Fertilizer and seeds	468 60		
Sundries	154 27		
Auto truck	415 91		
Live stock	50 00		
Total		$2,664 31	
Repairs to buildings and grounds:			
Buildings	733 10		
Plumbing	897 62		
Heating	170 67		
Grounds	122 37		
Total		$1,923 76	
Repairs and replacement of equipment:			
Repairs to fixtures	304 37		
Furniture	414 45		
Bedding and linen	3,211 61		
Crockery and silverware	180 34		
Kitchen furnishings	255 35		
Miscellaneous equipment	1,302 75		
Total		$5,668 87	
Miscellaneous:			
Telephone and telegraph	598 44		
Printing and stationery	551 76		
Transportation	393 35		
Laundry	4,644 90		
Mechanics' supplies	52 11		
Insurance and bonding	2,777 27		
Miscellaneous office expense	125 87		
Housekeeping supplies	1,377 67		
Hospital supplies	5,107 97		
Medicine	453 37		
Total	16,082 71		
Total expense for maintenance			92,002 47

Analysis of Expenses.

1919-1920.

Construction.

Gravel and binder for roads and grading	$1,767 00

EQUIPMENT.

Automobile	$1,000 00	
Miscellaneous equipment	185 00	
		$1,185 00

MAINTENANCE.

Salaries, wages and labor:

Medical	$4,948 00	
Administration	3,052 13	
Kitchen and dining room	6,913 56	
Domestic	1,095 85	
Ward service (male)	3,556 01	
Ward service (female)	4,530 22	
Engineering department	2,705 51	
Repairs	550 00	
Farm	3,172 99	
Stable, garage and grounds	19 33	
		$30,543 60

Food:

Butter	$3,108 30	
Butterine	482 65	
Beans	275 73	
Bread, crackers, etc.	291 02	
Cereals, rice, meal, etc.	760 27	
Cheese	176 80	
Eggs	3,109 50	
Flour	3,817 37	
Fish (fresh, cured and canned)	1,168 85	
Fruit (fresh)	299 15	
Fruit (dried and preserved)	2,427 11	
Lard and substitutes	640 16	
Macaroni and spaghetti	102 45	
Meats	16,134 84	
Milk	12,291 77	
Molasses and syrups	118 15	
Peanut butter, pie filling, etc.	10 50	
Potatoes	2,216 10	
Seasoning and condiments	312 31	
Sugar	9,517 58	
Tea, coffee, cocoa, etc.	499 22	
Vegetables (fresh)	432 37	
Vegetables (canned)	789 10	
Yeast and baking powder	161 40	
Sundries	901 69	
Freight and express	68 24	
Total		$60,112 63

Clothing and clothing materials:

Clothing	$29 45	
Dry goods	7 20	
		$36 65

Furnishings and household supplies:		
Carpets, rugs, etc.	$28 70	
Dry goods and small wares	184 08	
Furniture and upholstery	659 00	
Kitchen and household wares	652 36	
Laundry, supplies and materials	6,552 07	
Lavatory supplies and disinfectants	667 41	
Table linen, etc.	254 90	
Freight and express	97 22	
		$9,490 35
Heat, light and power:		
Coal	$8,632 96	
Electricity	2,926 96	
Operating supplies for boiler	285 47	
Sundries	45 00	
Freight and express	31 92	
		$11,922 31
Ordinary Repairs:		
Cement, lime, crushed stone, etc.	2 25	
Hardware, iron and steel	357 56	
Lumber, etc.	461 07	
Paint, oil, glass, etc.	4,473 67	
Plumbing and supplies	984 60	
Roofing material	12 00	
Tools and machines	2 35	
Boilers	110 88	
		$6,404 38
Farm and Stable:		
Carriage and wagon and repairs	54 79	
Fencing material	79 40	
Fertilizer	108 50	
Harness and repairs	45 20	
Horses	521 75	
Poultry, feed, etc.	1,757 30	
Other live stock	36 00	
Poultry brooders	74 25	
Road work and materials	9 63	
Stable and barn supplies	6 95	
Tools and machinery	34 75	
Trees, vines and seeds	73 97	
Sundries	18 26	
Freight and express	3 56	
		$2,824 31
Grounds:		
Sundries		$32 50
Medical and General Care:		
Entertainments	19 93	
Ice and refrigeration	70 59	
Medicine (supplies and apparatus)	1,591 02	

Sputum cups, etc.	57 43	
Tobacco, pipes, etc	10 00	
Freight and express	14 22	
		$1,763 19

Office and Incidental Expense, Travel:		
Insurance	936 81	
Religious instruction	102 00	
Auto repairs and supplies	1,667 93	
Printing and binding	155 45	
Stationery and office supplies	327 41	
Telephone and telegraph	849 23	
Travel	30 32	
Sundries	10 60	
Freight and expense	28 42	
		$4,108 17

Total expense for maintenance (1919-1920) $127,238 09

MAINTENANCE RESOURCES.

Goods on hand:	July 1, 1919.	July 1, 1920.
Fuel	$3,500 00	$600 00
Stock room	11,093 73	17,501 92
Drugs	450 00	500 00
Farm products	450 00	
	$15,493 73	$18,601 92

PER CAPITA.

Recapitulation and per capita:			
Stock on hand Oct. 1, 1918	$7,245 40	(7-1-19)	$15,493 73
Maintenance expense, 1918-19	92,002 47	(19-20)	142,731 82
	$99,247 87		$158,225 55
Stock on hand July 1, 1919	15,493 73	(7-1-20)	18,601 92
Actual maintenance expense	$83,754 14		$139,623 63
Total number of hospital days	37,666	50,612	
Cost per patient per day	$2.223	$2.362	
Cost per patient per week	15.561	18.935	
Average for two years		17.248	

VALUATIONS.

Land	$28,517 00
Sewer	10,695 33
Infirmary	121,243 00
Cottage No. 1	10,000 00
Cottage No. 2	13,000 00
Cottage No. 3	600 00

Shacks No. 1 and 2, dining hall and runs	51,419 00	
Women's shack	15,000 00	
Recreation hall and help's quarters	7,000 00	
Superintendent's cottage	12,000 00	
Disinfecting room and morgue	1,198 00	
Pumping stations	3,000 00	
Water towers and pipes	10,841 49	
Carriage house and workshop	200 00	
Incinerator	950 00	
Poultry department	3,000 00	
Barn and stable	1,500 00	
Auto truck	400 00	
Live stock	670 00	
Equipment of all	33,580 00	
Coal in stock	600 00	
Drugs and similar supplies	500 00	
Merchandise on hand	17,501 92	
		$343,415 74

REPORT OF THE FARM.

(July 1, 1919, to June 30, 1920).

Products delivered to sanatorium:		
Potatoes, at market price	$286 00	
Fruit, at market price	53 40	
Vegetables, at market price	814 70	
Wood, at market price	240 00	
Stock (pigs)	670 00	
Stock (guinea pigs)	26 25	
		$2,089 92
Sales:		
Produce outside	$29 50	
Pigs	90 00	
		119 50
Total receipts		$2,209 42
Expenses:		
Labor	$1,457 00	
Expenses (farm, stable and grounds)	972 00	
		$2,429 00
Loss		$219 58

POULTRY REPORT.

October 1st, 1918, to June 30th, 1919).

Stock on hand July 1st, 1919:		
425 hens	$637 50	
500 pullets	500 00	
500 chicks	250 00	
		$1,387 50

Income (delivered to sanatorium):		
Eggs (3,118 doz., at market price)	$1,715 17	
Chickens (1,588 lbs., at market price)	635 20	
		2,350 37
Total		$3,737 87
Expenditures:		
Labor, feed and supplies	$1,718 45	
Stock on hand Oct. 1st, 1918:		
250 yearlings, at market price	375 00	
800 chicks, at market price	1,200 00	
		3,293 45
Gain		$444 42

Poultry Report.

July 1st, 1919. to June 30th, 1920).

Stock on hand July 1st, 1920:		
250 hens and pullets	$500 00	
800 chicks	800 00	
		1,300 00
Income (delivered to sanatorium):		
Eggs (2,734 doz., at market price)	1,777 10	
Chickens (792 lbs., at market price)	371 00	
		2,148 10
Total		$3,448 10
Expenditures:		
Labor	$675 00	
Feed and supplies	1,621 30	
Stock on hand, July 1st, 1919:		
425 hens	637 50	
500 pullets	500 00	
100 chicks	50 00	
		3,483 80
Loss		$35 70

Financial Report of the State Tuberculosis Sanatorium at Hartford.

DR. WILLIAM M. STOCKWELL	*Superintendent*
DR. GEORGE L. BUNNELL	*Resident Physician*
MISS KATHLEEN N. REEN	*Head Nurse*
MISS MARY B. KEYES	*Housekeeper*
MISS FLORENCE BRINDLEY	*Bookkeeper*
MISS EMILY M. WEATHERHEAD	*Stenographer*
MISS ELISABETH LIGHTFOOT	*Teacher*
FRANCIS T. ROBERTS	*Engineer*

REPORT FOR YEARS ENDING JUNE 30, 1919, AND JUNE 30, 1920.

CASH ACCOUNT.

Institution Receipts:	Year 1918-19.	1919-20.	
Board of patients:			
Towns	$15,221 68	$20,463 56	
Associations	5,170 54	7,560 34	
Individuals	4,406 87	7,351 48	
	$24,799 09	$35,375 38	
Total receipts for board, Oct. 1, 1918-June 30, 1920			$60,174 47
Miscellaneous receipts:			
Clothing	$949 65	$931 84	
Telephone and telegram	17 36	49 98	
Transportation	2 35		
Construction payroll		36 86	
Miscellaneous sales	1,993 11	2,440 14	
	$2,962 47	$3,458 82	
Total miscellaneous receipts, Oct. 1, 1918-June 30, 1920			$6.421 29
To bills of institution paid by State Tuberculosis Commission:			
	Year 1918-19.	1919-20.	
Construction	$4,824 49	$328 06	
Equipment	375 00	591 00	
Maintenance	108,907 65	136,360 70	
	$114.107 14	$137,279 76	
Total of all bills paid by State Tuberculosis Commission			$251,386 90
Cash on hand October 1, 1918			644 71
Total receipts from all sources			$318.627 37

PAYMENTS.

	Year 1918-19.	1919-20.	
To Secretary of State Tuberculosis Commission:			
Patients' board	$24,656 79	$34,827 31	
Miscellaneous sales	2,010 47	2,490 12	
Refunds on patients' board	372 52	462 56	
Due from Comptroller, weekly payroll	36 86		
Transportation	2 35		
Purchase of clothing	949 65	931 84	
Bills paid by State Tuberculosis Commission	114,107 14	138,627 37	
Cash on hand, July 1, 1920		500 00	
	$142,135 78	$176,491 59	
Total expenditures, October 1, 1918-June 30, 1920			$318,627 37

RESOURCES AND LIABILITIES.

Resources.

Cash on hand July 1, 1920	$500 00	
Accounts receivable:		
Towns and cities	1,833 32	
Associations	938 30	
	$3,271 62	
Less advance payment on patients' board	250 79	
		$3,020 83

Liabilities.

Due State Tuberculosis Commission from Institution as per resources	3,020 83

ANALYSIS OF EXPENSES.

	Year 1918-19.	1919-20.	
Equipment, not including replacement of any kind:			
Dental equipment	$375 00		
Miscellaneous equipment	5 00	$591 00	
	$380 00	$591 00	
Total			$971 00

Construction:	
Coal bins	$800 00
Poultry plant	451 22
Sewage plant	3,400 73
Storeroom	172 54

Additional infirmary bed accommodations		$328 06	
Laundry		25,000 00	
	$4,824 49	$25,328 06	
Total			$30,157 55
Total expenses for equipment and construction			$36,123 55

MAINTENANCE.

	Years 1918-19.	1919-20.	
Salaries, wages and labor:			
General administrative and office	$11,850 47		
Medical service	11,251 88		
Farm, stable and grounds	2,425 51		
Medical		$5,521 43	
Administration		3,435 94	
Kitchen and dining-room service		7,035 71	
Domestic		1,625 78	
Ward (male)		4,476 05	
Ward (female)		7,007 56	
Industrial		638 72	
Engineering		2,188 11	
Laundry		4,957 67	
Farm		3,031 98	
Stable, garage and grounds		1,252 07	
	$25,527 86	$41,171 02	
Total			$66,698 88
Food:			
Meat	$9,246 32	$13,328 40	
Eggs	3,373 50	5,831 97	
Butter	2,770 34	3,790 50	
Milk	9,207 05	15,318 35	
Fish	846 14	1,112 23	
Flour	2,028 73	4,669 45	
Sugar	3,964 67	3,993 91	
Vegetables	861 67	524 50	
Fruit	800 98	1,571 89	
Canned goods	5,736 67	230 30	
Tea and coffee	787 64	628 94	
Miscellaneous	2,449 98	977 10	
Beans		188 99	
Bread, crackers, etc.		251 22	
Cereals, rice, meal		690 24	
Cheese		100 02	
Lard		122 73	
Macaroni and spaghetti		112 86	
Molasses and syrups		87 47	
Peanut butter		4 34	

Potatoes		1,532 25	
Seasoning and condiments		324 07	
Yeast and baking powder		215 09	
	$42,073 69	$55,606 82	
Total			$97,680 51
Furnishings and Household Supplies: Equipment:			
Repairs to fixtures	$743 86		
Furniture	1,499 42	$837 95	
Bedding and linen	6,183 98	374 03	
Crockery and silverware	1,157 55	210 92	
Kitchen furnishings	50 79	518 66	
Medical equipment	5 13		
Miscellaneous	1,905 00	748 51	
Carpets, rugs, etc.		425 50	
Dry goods and small wares		114 15	
Laundry supplies and materials		42 54	
Lavatory supplies and distinfectants		277 70	
Electric lamps		296 84	
Freight and express		2 17	
	$11,545 73	$3,848 97	
Total			$15,394 70
Heat, light and power:			
Coal	$11,253 00	$4,857 96	
Electric lights	1,208 76		
Gasoline, oil and wood	584 69	832 18	
Electric power	860 43		
Freight on coal		55 50	
Electricity		2,927 41	
Sundries		85 30	
	$13,906 88	$8,758 35	
Total			$22,665 23
Ordinary repairs:			
Buildings	$176 00		
Plumbing	14 49	$325 61	
Sewers	97 10		
Brick		2 00	
Cement, lime, etc.		25 95	
Electrical work and supplies		72 82	
Hardware, iron and steel		197 06	
Labor		96 25	
Lumber		9 77	
Paint, oils, glass, etc.		280 17	
Steam fittings and supplies		126 11	
Tools and machines		197 14	
Boilers		208 85	

Sundries		1,141 16	
Freight and express		3 29	
	$287 59	$2,686 18	
Total			$2,973 77
Farm and stable:			
Poultry	$28 95	$307 40	
Carriage and harness repairs	86 45	85 00	
Horses	725 20		
Farm tools	45 23		
Fertilizer and seeds	838 50	701 24	
Sundries	404 15	7 30	
Auto	1,528 01		
Blacksmithing and supplies		86 67	
Grain, etc.		615 73	
Hay		394 19	
Labor		80 00	
Spraying materials		23 35	
Stable and barn supplies		3 75	
Tools and machinery		126 84	
Freight and express		35	
	$3,656 49	$2,431 82	
Total			$6,088 31
Medical and general care:			
Laboratory supplies and apparatus		$18 31	
Manual training supplies		17 34	
Medical supplies and apparatus	$4,315 04	2,645 41	
School books and supplies	6 36	16 00	
Sputum cups, etc.		25 50	
Tobacco		4 75	
Water	1,009 44	1,120 56	
	$5,330 84	$3,847 87	
Total			$9,178 71
Office and incidental expense:			
Automobiles		$7,185 00	
Auto repairs and supplies		1,720 41	
Printing and binding	$124 43	424 13	
Postage		25 14	
Advertising		49 94	
Stationery and office supples	436 50	232 15	
Telephone and telegram	303 35	437 00	
Travel	44 19	56 14	
Sundries		103 09	
Freight and express		495 26	
	$908 47	$10,728 26	
Total			$11,636 73

Miscellaneous:			
Grounds (trees)		$52 00	
Insurance and bonding	$1,146 72	2,194 35	
Laundry supplies	4,523 38	6,023 31	
Freight		5 00	
Labor		1 50	
Repairs		5 25	
	$5,670 10	$8,281 41	
Total			$13,951 51
Total expenses for maintenance			$245,268 35

MAINTENANCE RESOURCES.

Goods on hand:		
Fuel	$5,616 81	
Stockroom	16,346 79	$18,531 59
Bedding and linen	6,151 55	3,423 13
Drug and lavatory supplies	4,711 43	3,907 00
Total	$32,826 58	$25,861 72

PER CAPITA.

Recapitulation and per capita:		
Stock on hand Oct. 1, 1918	$14,365 15	$32,826 58
Maintenance expense	108,907 65	136,360 70
Total	$123,272 80	$169,187 28
Stock on hand July 1, 1919	32,826 58	25,861 72
Maintenance expense	$90,446 22	$143,325 56
Maintenance less sales	1,993 11	2,440 14
Actual maintenance expense	$88,453 11	$140,885 42
Total number of hospital days	41.026	58,253
Cost per patient per day	$2.156	$2.418
Cost per patient per week	$15.09	$16.926
Average for two years		$16.008

VALUATIONS.

Land	$5,000 00
Dormitories	65,500 00
Dwelling houses	24,100 00
Barns and storehouses	4,150 00
Sheds and ice houses	450 00
Other buildings, including barns	39,356 95
Vehicles	7,870 00
Live stock	2,982 50

Merchandise on hand	36,172 89	
Tools and appliances	4,408 65	
Furniture and equipment	11,112 01	
Drugs and other similar supplies	3,907 00	
Total		$205,010 00

Report of the Farm, 1919.

Products delivered to sanatorium:

1 bushel beets	$1 50	
4 bushels peppers, at $1.75	7 00	
470 lbs. cabbage, at $.08	37 60	
7 bushels tomatoes, at $2.00	14 00	
2 bushels carrots, at $1.75	3 50	
12 bushels parsley, at $1.00	12 00	
4,212 lbs. pork, at $.38	1,600 56	
2 tons oats, at $50.00	100 00	
Total		$1,776 16

October 1, 1918, to June 30, 1919.

Inventory September 30, 1918:

Miscellaneous tools	$412 90	
Hogs	1,800 00	
Pigs	405 00	
Hog houses and runs	284 46	
Total inventory	$2,902 36	

Expenses for 1919:

Salaries	$1,819 13	
Horses	362 60	
Fertilizer, seeds, etc.	838 50	
Blacksmith	86 45	
Tools	45 23	
Rent of land	135 00	
Sundries	224 15	
Total expenses	$3,511 06	
Total expense and inventory		$6,413 42

Receipts for 1919:

Vegetables, at market price	$75 60	
Pork, 4,212 lbs., at 38c.	1,600 56	
2 tons oats, at $50.00	100 00	
Total receipts		$1,776 16

Sales:		
Plants	$5 00	
Guinea pigs	42 00	
Hogs	855 90	
Total sales	$902 90	
Total sales and products		$2,679 06
Inventory:		
Wagons	250 00	
Fertilizer	50 00	
Horses	600 00	
Poultry	361 50	
Hogs	1,200 00	
Miscellaneous tools	267 40	
Hog houses and runs	225 00	
Total inventory	$2,953 90	
Total inventory, sales and products		$5,632 96
Deficit		$780 46

REPORT OF THE FARM, 1920.

Products delivered to sanatorium:		
17 bushels beets, at $1.25	$21 25	
5 bushels string beans, at $1.10	5 50	
3,934 lbs. cabbage, at $.06	236 04	
50 bushels carrots, at $1.65	82 50	
530 doz. corn, at $.25	132 50	
2½ bbls. kale, at $3.75	9 38	
3 bushels kohlrabi, at $2.00	6 00	
2½ bushels peppers, at $2.25	5 63	
15 baskets peaches, at $1.10	16 50	
904 lbs. pumpkins, at $.05	45 20	
72 doz. summer squash, at $1.60	115 20	
398 lbs. Hubbard squash, at $.06½	25 87	
480 bunches radishes, at $.04	19 20	
198 baskets tomatoes, at $.55	108 90	
465 lbs. rhubarb, at $.08	37 20	
134 bushels turnips, at $1.95	261 30	
545 bunches rareripes, at $.09	49 05	
24 doz. lettuce, at $1.25	30 00	
84 doz. cucumbers, at $.22	18 48	
9 bushels onions, at $2.50	22 50	
517 bushels potatoes, at $3.50	1,809 50	
359 bushels field corn, at $.80	287 20	
147 bushels sweet corn, at $.80	117 60	
3,854 lbs. pork, at $.30	1,156 20	
Total		$4,618 70

Report of the Farm.

July 1, 1919, to June 30, 1920

Inventory, June 30, 1919:		
Wagons	$250 00	
Fertilizer	50 00	
Horses	600 00	
Poultry	361 50	
Hogs	1,200 00	
Miscellaneous tools	267 40	
Hog houses and runs	225 00	
Total inventory		$2,953 00
Expenses for 1920:		
Horses	$400 00	
Salaries	2,021 32	
Blacksmithing and supplies	86 67	
Carriage and wagons and repairs	85 00	
Fertilizer and seeds	701 24	
Grain, hay, etc.	1,009 92	
Poultry	307 40	
Tools	126 84	
Rent of land	180 00	
Sundries	34 75	
Total expense		$4,953 14
Total expense and inventory		$7,906 14
Receipts for 1920:		
Vegetables, at market price	$3,462 50	
Pork, 3,854 lbs., at 30c.	1,156 20	
Total receipts		$4,618 70
Sales:		
Plants	$7 25	
Guinea pigs	12 00	
Hogs	771 00	
Miscellaneous sales	5 80	
Total sales	$796 05	
Total sales and products		$5,414 75
Inventory:		
Wagons	$285 00	
Hogs	2,000 00	
Poultry	382 50	
Miscellaneous tools	336 55	

Sundries	150 20	
Hog houses and runs	500 00	
Total inventory	$3,654 25	
Total inventory, sales and products		$9,069 00
Gain		$1,162 86

Financial Report of the State Tuberculosis Sanatorium at Norwich.

DR. HUGH BAIRD CAMPBELL	*Superintendent*
DR. M. M. TEPLITZ	*Resident Physician*
MISS CLARA M. CHRISTOPH	*Secretary*
MR. E. J. DEEGAN	*Stenographer*
MISS MIRIAM M. CAMPBELL	*Housekeeper*

Cash Account.

Institution Receipts:	1918-19.	1919-20.	
Board of patients:			
Towns	$4,481 03	$9,562 13	
Associations	3,082 12	8,763 90	
Private	9,041 94	14,245 10	
Total receipts for board Oct. 1,1918-July, 1920			$49,176 22
Miscellaneous receipts:			
Miscellaneous sales:			
	270 58	761 14	1,031 72
To bills of institution paid by State Tuberculosis Commission:			
Maintenance	$91,239 51	$122,247 13	
Equipment	25,557 25	1,185 00	
Construction	6,107 56	2,500 00	
	$122,904 32	$125,932 13	
Total of all bills paid by State Tuberculosis Commission			$248,836 45
Cash due from State Tuberculosis Commission:			
Weekly payroll—Sept. 30, 1918			10 50
Office account—Sept. 30, 1918			6 01
Cash on hand—Sept. 30, 1918			202 04
Total receipts from all sources			$299,262 94

Payments.

	1918-19.	1919-20.	
To Secretary State Tuberculosis Commission	$14,942 86	33,415 69	
Bills paid by State Tuberculosis Commission	122,874 37	125,294 13	
Due on weekly payroll		516 74	
Due on office account		81 40	
Refund on patients' board	281 92	687 88	
Cash on hand June 30, 1920		500 00	
	$138,099 15	$160,495 84	
Total payments			$298,594 99

Resources and Liabilities.

Resources.

Cash on hand June 30, 1920	$500 00	
Bills due from towns and cities	946 76	
Bills due from associations	331 77	
Bills due from private patients	7 83	
		$1,786 36

Liabilities.

Due State Tuberculosis Commission from Institution as per resources	$1,786 36

Analysis of Expenses.

New equipment, not including replacement of any kind:

	1918-19.	1919-20.	
Dental	$375 00		
Screens	1,081 00		
Automobile		$1,000 00	
Miscellaneous	24,476 25	185 00	
	$25,932 25	$1,185 00	
Total			$27,117 25

Construction:

Infirmary	$2,652 00		
Additional storeroom	1,227 74		
Superintendent's cottage	2,212 72		
Barn—Insurance fund	15 10		
Glass sash		$2,500 00	
	$6,107 56	$2,500 00	
Total			$8,607 56

Maintenance:

	1918-19.	1919-20.	
Salaries	$24,485 47	$41,285 97	
Office and travel	1,441 35	1,836 19	
Food	29,791 25	50,518 42	
Clothing and materials	22 54	23 26	
Furnishing and household supplies	6,086 04	3,665 49	
Medical and general	5,728 55	4,041 48	
Heat, light and power	8,135 46	7,947 25	
Farm and stable	1,215 86	1,030 65	
Grounds	257 32	225 18	
Ordinary repairs	7,713 36	3,119 85	
Laundry	4,163 93	6,883 55	
Insurance	1,849 64	681 07	
Auto repairs	248 74	964 77	
Religious services		24 00	
	$91,239 51	$122,247 13	
Total maintenance			$213,486 64

MAINTENANCE RESOURCES.

Goods on hand:	1918-19.	1919-20.
Fuel	$4,986 71	$3,000 00
Stockrooms	10,196 82	12,759 86
Bedding and linen	3,036 63	3,394 45
Drugs	441 43	650 18
Total	$18,661 59	$19,804 49

PER CAPITA.

Recapitulation and per capita:			
Stock on hand Oct. 1, 1918	$16,980 73	(7-1-19)	$18,661 59
Total maintenance	91,239 51		122,247 13
	$108,220 24		$140,908 72
Stock on hand 7-1-19	18,661 59	(7-1-20)	19,804 49
	$89,558 65		$121,104 23
Maintenance less sales	270 58		761 14
Total	$89,288 07		$120 343 09

Total number of hospital days	28,991	50,930
Cost per patient per day	$3.079	$2.362
Cost per patient per week	$21.55	$16.534
Average for two years		$19.042

VALUATIONS.

Thirty-one acres	$11,000 00	
Buildings	137,300 00	
Live stock and vehicles	2,200 00	
Equipment, including beds and bedding, linens, household supplies and farm equipment	36,589 50	
Total		$187,089 50

REPORT OF FARM, 1918-20

Products delivered to sanatorium:		
Vegetables, at market prices	$650 10	
Potatoes, at market price	1,428 00	
		$2,078 10
Services rendered:		
Team and services		2,520 00
Sales		34 50
		$4,632 60
Expenses:		
Labor	$3,495 70	
Expenses	2,246 41	
		5,742 11
Farm deficit		$1,109 51

Financial Report of The Seaside, Niantic, Conn.

DR. JOHN FRANCIS O'BRIEN	*Superintendent*
MRS. SARA E. COLGAN	*Head Nurse*
MR. JOHN H. ADAMS	*Secretary*

REPORT FOR YEAR ENDING JUNE 30, 1920.

CASH ACCOUNT.

Institution Receipts:		
Board of patients:		
Towns and cities	$830 59	
Associations	500 17	
Individuals	482 62	
Total receipts for board Dec. 27, 1919-June 30, 1920		$1,813 38
Miscellaneous receipts:		
Telephone, miscellaneous sales, etc.	$21 00	
Total miscellaneous receipts		$21 00
To bills of institution paid by State Tuberculosis Commission:		
Maintenance	$14,383 76	
Equipment	14,378 19	
Construction	19,868 01	
Total of all bills paid by State Tuberculosis Commission		48,629 96
Total receipts from all sources		$50,464 34

PAYMENTS.

To Secretary of State Tuberculosis Commission:		
Refunds on patients' board	$1 71	
Cash on hand, June 30, 1920	1,832 67	
Total expenditures, Dec. 27, 1919-June 30, 1920		$1,813 38

RESOURCES AND LIABILITIES.

Resources.

Cash on hand, June 30, 1920	$924 66	
Accounts receivable:		
Towns and cities	421 60	
Associations	174 35	
Individuals	32 05	
		$1,552 66

Liabilities.

Due State Tuberculosis Commission from institution as per resources		$1,552 66

ANALYSIS OF EXPENSES.

Equipment, not including replacement of any kind:		
Children's equipment	$11,407 04	
Miscellaneous	2,971 15	
		$14,378 19
Construction:		
Children's Seaside		19,868 01
Total expenses for equipment and construction		$34,246 20

MAINTENANCE.

Salaries and wages	$5,490 27	
Office and travel	1,004 88	
Food	3,249 59	
Clothing and material	29 04	
Furnishing and household supplies	511 88	
Medical and general	615 55	
Heat, light and power	1,751 66	
Ordinary repairs	16 18	
Insurance	962 48	
Automobile	67 92	
Laundry	684 31	
Total expenses for maintenance		$14,383 76

PER CAPITA.

Recapitulation and per capita:	
Maintenance expenses	$14,383 76
Total number of hospital days	3,963
Cost per patient per day	$3.614
Cost per patient per week	$25.298

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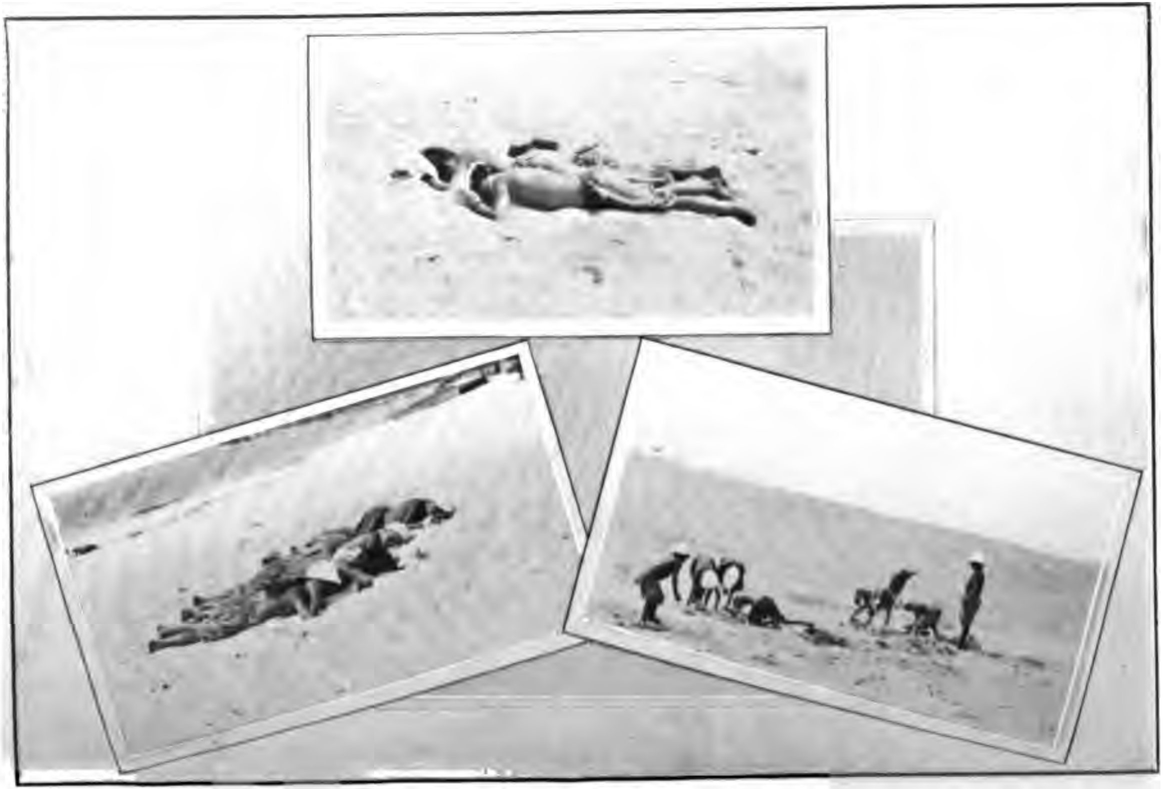

TAKING THE CURE AT "THE SEASIDE".

Medical Report of Five Sanatoria.

ONE YEAR, NINE MONTHS—OCTOBER 1, 1918, TO JUNE 30, 1919; JULY 1, 1919, TO JUNE 30, 1920.

TABLE 1—*Population.*

MERIDEN STATE TUBERCULOSIS SANATORIUM.

	1918-1919			1919-1920		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
Beginning	59	49	108	58	51	109
Admitted	89	47	136	91	50	141
Discharged	43	27	70	51	32	83
Died	43	22	65	36	20	56
Remaining	58	51	109	62	49	111
Daily Average	54	46	100	59	46	105

SHELTON STATE TUBERCULOSIS SANATORIUM.

	1918-1919			1919-1920		
	Male	Female	Total	Male	Female	Total
Beginning	71	32	103	95	51	146
Admitted	216	128	344	181	157	338
Discharged	136	73	209	138	112	250
Died	56	36	92	63	40	103
Remaining	95	51	146	75	56	131
Daily Average	69	34	103	86	52	138

HARTFORD STATE TUBERCULOSIS SANATORIUM.

	1918-1919			1919-1920		
	Male	Female	Total	Male	Female	Total
Beginning	98	42	140	113	43	156
Admitted	113	57	170	140	96	236
Discharged	51	31	82	90	53	143
Died	47	25	72	47	43	90
Remaining	112	44	156	116	43	159
Daily Average	109	41	150	116	43	159

Total died not included in discharged.

Norwich State Tuberculosis Sanatorium.

	1918-1919			1919-1920		
	Male	Female	Total	Male	Female	Total
Beginning	45	42	87	88	43	131
Admitted	148	64	212	211	90	301
Discharged	66	38	104	150	69	219
Died	39	25	64	62	19	81
Remaining	88	43	131	87	45	132
Daily Average	67.5	38.6	106.1	95.9	43.3	139

Total died not included in discharges.

The Seaside, 1919-1920.

	1919-1920		
	Male	Female	Total
Beginning	0	0	0
Admitted	25	25	50
Discharged	2	3	5
Died	0	0	0
Remaining	23	22	45
Daily Average	10	11	21

Table 2—*Hospital Days.*

	1918-19	1919-20
July		16,848
August		17,097
September		16,284
October	13,679	16,943
November	13,852	16,244
December	14,937	17,269
January	15,352	17,495
February	13,849	15,857
March	15,461	16,786
April	15,571	16,583
May	16,200	17,541
June	15,899	17,326
Total	134,800	202,273

Total Hospital Days.

	1918-19	1919-20
Meriden Sanatorium	27,117	38,515
Shelton Sanatorium	37,666	50,612
Norwich Sanatorium	28,991	50,980
Hartford Sanatorium	41,026	58,253
The Seaside		3,963

TABLE 3—*Length of Stay of Discharged Patients.*

	1918-19	1919-20
Under 3 months	268	351
3 months to 6 months	98	150
6 months to 1 year	60	124
1 year to 2 years	30	60
2 years and over	9	15
Total	465	700

Length of Stay of Patients Who Died.

	1918-19	1919-20
Under 3 months	175	149
3 months to 6 months	51	77
6 months to 1 year	25	47
1 year to 2 years	21	38
2 years and over	21	19
Total	293	330

TABLE 4—*Condition of Patients on Admission.*

MERIDEN STATE TUBERCULOSIS SANATORIUM.

	1918-19		1919-20		
	Male	Female	Male	Female	2 yrs. Total
Incipient	6	9	5	13	33
Moderately advanced	27	8	32	8	75
Far advanced	48	26	43	23	140
Bone	4	3	7	5	19
Renal	0	0	1	0	1
Glandular	0	1	0	1	2
Non-tuberculous	2	0	1	0	3
Not treated	2	0	2	0	4
Total	89	47	91	50	277

SHELTON STATE TUBERCULOSIS SANATORIUM.

	1918-19		1919-20		
	Male	Female	Male	Female	2 yrs. Total
Incipient	18	15	10	8	51
Moderately advanced	164	79	126	111	480
Far advanced	28	30	39	34	131
Acute miliary	0	0	0	0	0
Surgical	6	3	1	2	12
Non-tuberculous	0	1	5	2	5
Total	216	128	181	157	682

HARTFORD STATE TUBERCULOSIS SANATORIUM.

	1918-1919			1919-1920		
	Male	Female	Total	Male	Female	Total
Incipient	6	3	9	0	0	0
Moderately advanced	25	5	30	25	14	39
Far advanced	66	44	110	95	78	173
Acute	0	0	0	0	0	0
Bone	6	2	8	4	2	6
Glandular	9	3	12	8	1	9
Surgical	0	0	0	0	0	0
Non-tuberculous	1	0	1	8	1	9
Total	113	57	170	140	96	236

NORWICH STATE TUBERCULOSIS SANATORIUM.

	1918-19		1919-20		
	Male	Female	Male	Female	2 yrs. Total
Incipient	8	5	18	11	42
Moderately advanced	75	39	119	61	294
Far advanced	62	18	71	16	167
Bone	3	0	0	0	3
Non-tuberculous	0	2	3	2	7
	148	64	211	90	513

TABLE 5—*Condition of Patients on Discharge.*

MERIDEN STATE TUBERCULOSIS SANATORIUM.

	1918-19		1919-20		
	Male	Female	Male	Female	2 yrs. Total
Apparently arrested	2	4	6	3	15
Improved	28	10	29	21	88
Unimproved	9	13	16	8	46
Died	4	0	0	0	4
Non-tuberculous	0	0	0	0	0
Total	86	49	87	52	274

SHELTON STATE TUBERCULOSIS SANATORIUM.

	1918-1919		1919-1920		
	Male	Female	Male	Female	2 yrs. Total
Apparently arrested	14	4	8	3	29
Improved	72	30	79	45	226
Unimproved	50	36	46	56	188
Died	56	36	63	40	195
Non-tuberculous	0	3	5	8	16
Total	192	109	201	152	654

HARTFORD STATE TUBERCULOSIS SANATORIUM.

	1918-1919			1919-1920		
	Male.	Female	Total	Male	Female	Total
Apparently arrested	4	4	8	8	2	10
Improved	27	14	41	20	18	38
Unimproved	19	13	32	58	32	90
Died	47	25	72	47	43	90
Non-tuberculous	1	0	1	4	1	5
Total	98	56	154	137	96	233

NORWICH STATE TUBERCULOSIS SANATORIUM.

	1918-1919		1919-1920		
	Male	Female	Male	Female	2 yrs. Total
Apparently arrested	2	3	10	2	17
Improved	37	23	88	39	187
Unimproved	27	10	50	26	113
Non-tuberculous	0	2	2	2	6
Total	66	38	150	69	323

TABLE 6—*Civil Condition of Patients.*

	Male	Female	Total
Married	580	333	913
Single	567	330	897
Widowed	52	38	90
Divorced	14	13	27
Separated	1	0	1
Total	1214	714	1928

TABLE 7—*Ages of Patients Admitted.*

	Male	Female	Total
Under 14 years	77	69	146
14 to 20 years	107	133	240
21 to 30 years	363	270	633
31 to 40 years	315	168	483
41 to 50 years	225	44	269
51 to 60 years	93	23	116
Over 60 years	34	7	41
Total	1214	714	1928

TABLE 8—*Nativity of Patient, Father and Mother.*

Total for 1 year 9 months.

	Patient	Father	Mother
Connecticut	678	193	223
United States	330	242	219
Albania	1	1	1
Armenia	4	6	6
Austria-Hungary	112	149	155
Belgium	2	1	1
Bohemia	4	5	5
Canada	33	73	74
China	0	2	1
Denmark	2	6	6
England	32	60	63
Finland	10	14	12
France	4	11	7
Galacia	5	5	5
Germany	28	82	80
Greece	30	29	29
Holland	0	2	1
Ireland	112	331	338
Italy	208	257	255
Jamaica	1	1	1
Lithuania	6	9	9
Macedonia	1	1	1
Norway	2	7	5
Nova Scotia	2	1	3
Persia	8	8	8
Poland	106	123	124
Portugal	6	7	7
Roumania	3	6	6
Russia	121	149	144
St. Helena Island	0	0	1
Scotland	9	14	13
Slavonia	1	1	1
Sweden	40	64	65
Switzerland	3	3	3
Syria	9	9	9
Turkey	2	7	9
Unknown	12	46	40
Wales	1	2	3
West India	0	1	0
Total foreign	920	1493	1486
Total native	1008	435	442
Total	1928	1928	1928

TABLE 9—*Residence of Patients.*

	Total for 21 months		Total for 21 months
Addison	1	East Morris	1
Ansonia	29	Ellington	1
Abington	1	Enfield	2
Allingtown	1	Essex	1
Avon	1	Fairfield	9
Ballouville	1	Fair Haven	1
Baltic	2	Forestville	2
Beacon Falls	4	Glastonbury	10
Bethel	1	Glenbrook	3
Bloomfield	1	Granby	3
Branford	10	Guilford	2
Bridgeport	235	Greenville	3
Bridgewater	1	Greenwich	1
Bristol	33	Groton	7
Brooklyn	2	Hamden	2
Berlin	1	Hampton	1
Burnside	3	Hartford	188
Central Village	2	Huntington	1
Chester	2	Ivoryton	1
Collinsville	3	Kensington	7
Cromwell	5	Killingly	2
Canton	1	Lakeville	1
Cheshire	1	Leete's Island	1
Cos Cob	1	Litchfield	1
Danbury	26	Lisbon	1
Danielson	6	Long Hill	1
Deep River	2	Manchester	1
Derby	5	Madison	3
Devon	2	Meriden	61
East Hartford	9	Middlebury	2
East Haven	3	Middletown	20
East Haddam	1	Milford	7
East Hampton	1	Milldale	1
East Lyme	1	Moosup	7
Eastern Point	1	Mt. Carmel	1
East Portchester	1	Mystic	6
East Windsor	1	Naugatuck	20
East Norwalk	1	New Britain	75

TABLE 9—*Residence of Patients.—Continued.*

	Total for 21 months		Total for 21 months
New Haven	871	Stevenson	1
New London	76	Stony Creek	2
New Milford	1	Stonington	7
Newtown	3	Stratford	11
Norfolk	1	Taftville	7
Norwich	84	Terryville	5
Norwalk	19	Thomaston	5
New Canaan	3	Thompsonville	5
North Grosvenordale	2	Torrington	32
North Haven	2	Uncasville	1
North Stonington	3	Union City	5
North Westchester	1	Wallingford	17
Noroton	4	Warehouse Point	4
Oakville	4	Warrenville	1
Occum	1	Waterbury	169
Orange	1	Waterford	2
Plainfield	8	Watertown	1
Plainville	2	Waterville	3
Pomfret	2	West Allington	1
Portland	1	Westbrook	1
Putnam	9	West Cornwall	1
Ridgefield	1	West Hartford	1
Rockville	9	West Haven	13
Saybrook	1	Westport	2
Saugatuck	1	Westville	1
Sandy Hook	1	Wethersfield	3
Seymour	9	Whitneyville	1
Shelton	7	Willimantic	19
Somers	1	Windsor	3
Somersville	1	Windsor Locks	3
Southington	9	Windsorville	1
South Manchester	11	Woodbury	1
South Norwalk	13	Woodmont	1
Southport	1	Woodstock	1
South Windsor	3	Yalesville	1
Stafford Springs	3	Yantic	1
Stamford	53		

TABLE 10—*Occupation of Patients.*

	Male	Female	Total
Accountant	3	0	3
Actor	1	1	2
Assembler	4	0	4
Attendant	6	0	6
Auto Decorator	1	0	1
Baker	2	0	2
Bartender	8	0	8
Barber	9	0	9
Barrel worker	1	0	1
Belt maker	1	0	1
Blacksmith	6	0	6
Boatman	1	0	1
Bookkeeper	3	10	13
Box maker	2	0	2
Brakeman	5	0	5
Braid maker	1	0	1
Brass worker	10	0	10
Bricklayer	1	0	1
Buffer	7	0	7
Butcher	4	0	4
Cabinet maker	1	0	1
Candy maker	1	0	1
Carpenter	25	0	25
Cashier	1	1	2
Chauffeur	1	0	1
Checker	1	1	2
Cleaner	3	0	3
Clergyman	1	0	1
Clerk	33	27	60
Clerical work	21	8	29
Clockmaker	1	0	1
Cigarmaker	4	0	4
Caretaker	1	0	1
Contractor	2	0	2
Conductor	6	0	6
Commercial artist	1	0	1
Cook	7	2	9
Coremaker	2	0	2
Corset cutter	1	0	1
Crane operator	1	0	1
Cooper	1	0	1

TABLE 10—*Occupation of Patients.—Continued.*

	Male	Female	Total
Dentist	1	0	1
Dentist helper	1	0	1
Dishwasher	2	0	2
Draughtsman	2	0	2
Dressmaker	0	5	5
Driller	3	0	3
Driver	3	0	3
Drop forger	1	0	1
Druggist	2	0	2
Electro plater	1	0	1
Electrician	1	0	1
Elevator operator	2	0	2
Engineer	8	0	8
Engraver	2	0	2
Expressman	2	0	2
Factory hand	131	97	228
Farm hand	85	1	86
Filer	2	0	2
Finisher	1	0	1
Fireman	7	0	7
Furniture upholsterer	1	0	1
Fisherman	1	0	1
Foreman	8	0	8
Forger	4	0	4
Foundryman	1	0	1
Game keeper	1	0	1
Garage helper	1	0	1
Gardener	5	0	5
Granite cutter	3	0	3
Grinder	22	0	22
Grocer	6	0	6
Gunsmith	3	0	3
Hatter	8	0	8
Housewife	0	324	324
Housework	0	70	70
Horse trainer	8	0	8
Inspector	8	3	11
Insurance agent	3	0	3
Janitor	10	1	11
Jitney driver	2	0	2
Junk dealer	2	0	2
Laborer	201	0	201

Table 10—*Occupation of Patients.—Continued.*

	Male	Female	Total
Lathe hand	1	0	1
Laundry man	2	0	2
Lithographer	1	0	1
Linotype operator	1	0	1
Lock maker	3	0	3
Loom fixer	1	0	1
Lunch man	1	0	1
Machinist	57	0	57
Machine operator	35	2	37
Marine engineer	1	0	1
Mason	3	0	3
Merchant	3	0	3
Messenger	2	0	2
Metal polisher	1	0	1
Meter reader	1	0	1
Mill hand	16	7	23
Motorman	2	0	2
Moulder	14	0	14
Mechanic	12	0	12
Newsdealer	2	0	2
Night watchman	2	0	2
No occupation	20	12	32
Nurse	0	13	13
Nursemaid	0	2	2
Orderly	3	0	3
Oysterman	2	0	2
Packer	0	1	1
Painter	14	0	14
Paper ruler	1	0	1
Pattern maker	1	0	1
Paymaster	1	0	1
Peanut vender	1	0	1
Peddler	4	0	4
Photographer	1	0	1
Piano maker	1	0	1
Plater	3	0	3
Plumber	16	0	16
Polisher	3	0	3
Policeman	3	0	3
Porter	1	0	1
Pool room proprietor	1	0	1
Pressman	3	0	3

TABLE 10—*Occupation of Patients.—Continued.*

	Male	Female	Total
Printer	6	2	8
Pupils	54	58	112
Restaurant proprietor	3	0	3
Roofer	3	0	3
Rubber worker	9	1	10
Sailor	5	0	5
Saloon keeper	1	0	1
School teacher	1	4	5
Sheriff	1	0	1
Ship builder	1	0	1
Shoemaker	5	0	5
Showman	1	0	1
Silver finisher	0	1	1
Silver plater	2	0	2
Singer	0	1	1
Salesman	13	5	18
Soldier	18	0	18
Spinner	4	2	6
Stage hand	1	0	1
Station man	1	0	1
Stenographer	0	5	5
Stone mason	8	0	8
Student	6	0	6
Steam fitter	4	0	4
Solderer	13	0	13
Tailor	10	0	10
Tanner	9	0	9
Teamster	35	0	35
Telephone operator	0	6	6
Timekeeper	1	0	1
Threader	1	0	1
Tobacco sorter	1	2	3
Tool maker	9	0	9
Trimmer	1	0	1
Waiter	18	7	25
Warper	0	1	1
Ward maid	0	1	1
Watchman	7	0	7
Weaver	24	7	31
Wood turner	5	0	5
Watchmaker	3	0	3
Winder	0	3	3

Report of the Secretary.

BEGINNING OCTOBER 1, 1918, AND ENDING JUNE 30, 1919.

MAINTENANCE.

Receipts.

Cash on hand October 1, 1918		$5,513 14
Maintenance appropriation	$228,758 62	
Transferred from laundry appropriation to Maintenance appropriation, October 11	5,000 00	
Emergency appropriation	100,000 00	
Board of patients, Hartford Sanatorium	24,656 79	
Board of patients, Meriden Sanatorium.	15,571 56	
Board of patients, Norwich Sanatorium	14,673 08	
Board of patients, Shelton Sanatorium..	23,603 80	
Misc. receipts, Hartford Sanatorium	2,010 47	
Misc. receipts, Meriden Sanatorium	134 48	
Misc. receipts, Norwich Sanatorium	269 78	
Misc. receipts, Shelton Sanatorium	16 98	
		$414,695 56
Total		$420,208 70

Disbursements.

Maintenance of Hartford Sanatorium	$108,907 65	
Maintenance of Meriden Sanatorium	82,297 94	
Maintenance of Norwich Sanatorium	91,239 51	
Maintenance of Shelton Sanatorium	92,002 47	
		$374,447 57
Balance, cash on hand June 30, 1919	$3,448 81	
Balance, maintenance appropriation	42,155 97	
Cash advanced on office account	156 35	
		$45,761 13
Total		$420,208 70

CONSTRUCTION.

	Appropriation.	Expended to June 30,'20.	Balance.
Coal bins	$1,000 00	$800 00	$200 00
Hartford poultry plant	462 60	451 22	11 38
Hartford sewage plant	4,280 76	3,400 73	880 03
Incinerator, Norwich and Shelton	1,273 00		1,273 00
Laundry	25,000 00		25,000 00
Additional infirmary accommodations at Norwich	2,773 60	2,652 00	121 60
Norwich isolation rooms	1,200 87		1,200 87
Norwich superintendent's cottage	2,117 05	2,212 72	

Norwich superintendent's cottage (transferred from Shelton infirmary appropriation).	95 67		
Additional storeroom facilities	1,432 80	1,378 68	54 12
Shack alteration	959 44	745 00	214 44
Completion of Shelton infirmary	1,334 21	1,213 14	121 07
Stable and wagon shed, Shelton	966 98		966 98
Shelton water supply	1,763 00	1,700 00	63 00
Sleeping porches	3,000 00	3,000 00	
Total construction appropriation			$47,695 98

Disbursements.

Total expended on construction appropriation	$17,553 49	
Balance, cash on hand	30,106 49	
Total		$47,695 98

EQUIPMENT.

	Appropriation.	Expended to June 30,'20.	Balance.
Auto trucks	$107 97		$107 97
Dental equipment	1,500 00	$750 00	750 00
Miscellaneous equipment	39,875 90	38,266 94	1,608 96
Equipment Shelton infirmary	1,539 25	574 34	964 91
Total equipment appropriation			$43,023 12

Disbursements.

Total expended on equipment appropriation	$39,591 28	
Balance, cash on hand	3,431 84	
Total		$43,023 12

Note: The following balances of appropriations were transferred to Miscellaneous Equipment Approriation by order of the Board of Control:

Balance—Glass sash appropriation	$15 34	
" Norwich isolation rooms	1,200 87	
" Incinerator	1,220 16	
" Root cellar	284 81	
" Shack alterations	214 44	
" Stable and wagon shed	966 98	
" Shelton water supply	63 00	
" Auto trucks	107 97	
" Hartford sewage plant	880 03	
" Norwich additional infirmary	121 60	
" Shelton infirmary equipment	964 91	
" Shelton infirmary	25 40	
Total		$6,065 51

Salaries and Expenses of Commissioners, Secretary and Commission Office.

Receipts

Commissioners' salary appropriation	$8,854 14	
Commissioners' expense apporiation	2,016 67	
Secretary's salary appropriation	2,000 00	
Commission office expense appropriation	2,451 11	
Total		$15,321 92

Disbursements.

Dr. Stephen J. Maher, salary	$1,874 97	
Dr. Stephen J. Maher, expense	300 00	
Wallace S. Allis, salary	1,874 97	
Wallace S. Allis, expense	300 00	
Arthur R. Kimball, salary	1,874 97	
Arthur R. Kimball, expense	300 00	
George I. Allen, Secretary, salary	1,499 94	
Commission office expense	2,451 11	
Total		$10,475 96
Balance of appropriation reverted to State treaury:		
Balance—Commissioners' expense	$1,116 67	
" Commissioners' salary	3,229 23	
" Secretary's salary	500 06	
Total		4,845 96
Total		$15,321 92

BEGINNING JUNE 30, 1919, AND ENDING JUNE 30, 1920.

Maintenance.

Receipts.

Cash on hand July 1, 1919		$3,448 81
Maintenance appropriation	$796,000 00	
Board of patients at Hartford Sanatorium	34,827 31	
Board of patients at Meriden Sanatorium	20,994 36	
Board of patients at Norwich Sanatorium	32,989 09	
Board of patients at Shelton Sanatorium	30,212 09	
Misc. receipts, Hartford Sanatorium	2,490 12	
Misc. receipts, Meriden Sanatorium	649 22	
Misc. receipts, Norwich Sanatorium	429 50	

Disbursements.

Maintenance of Hartford Sanatorium	$136,360 70	
Maintenance of Meriden Sanatorium	95,512 79	
Maintenance of Norwich Sanatorium	122,247 13	
Maintenance of Shelton Sanatorium	127,238 09	
Maintenance of The Seaside	14,383 76	
Maintenance of Hartford Sanatorium, 1917-19 appropriation	5,278 31	
Maintenance of Meriden Sanatorium, 1917-19 appropriation	10,547 49	
Maintenance of Norwich Sanatorium, 1917-19 appropriation	1,413 17	
Maintenance of Shelton Sanatorium, 1917-19	9,403 42	
		$522,384 86
Balance, cash on hand, June 30, 1920	$12,266 61	
Balance, maintenance appropriation	417,218 74	
Balance, maintenance appropriation, 1917-19, reverted to Treasurer's office	9,952 69	
Cash advanced on office account	273 13	
		443,913 42
Total		$966,298 28

CONSTRUCTION.

	Appropriation.	Expended to June 30,'20.	Balance.
Hartford poultry plant	$1,000 00		$1,000 00
Additional infirmary bed accommodations, Meriden and Hartford	3,000 00	$383 68	2,616 32
Meriden fire protection	5,000 00		5,000 00
Meriden infirmary	75,000 00		75,000 00
Meriden wagon shed	500 00		500 00
Norwich glass sash	2,500 00	2,500 00	
Roads and grading, Shelton	3,000 00	1,767 00	1,233 00
Additional storeroom, 1917-19	54 12	21 60	32 52
Children, 1917-19	19,878 47	19,868 01	10 46
Laundry plant, 1917-19	25,000 00	25,000 00	
Total construction appropriation			134,932 59

Disbursements.

Total expended on construction appropriation	$49,540 29	
Balance, cash on hand	85,349 32	
Reverted to State Treasurer's office	42 98	
Total		$134,932 59

Misc. receipts, Shelton Sanatorium	992 47	
Credits on cancelled checks	1,109 34	
Maintenance appropriation, 1917-1919	42,155 97	
		962,849 47
Total		$966,298 28

EQUIPMENT.

	Appropriation.	Expended to June 30,'20.	Balance.
Automobile	$2,000 00	$2,000 00	
Dental, 1917-19	750 00	750 00	
Children's Seaside	12,000 00	11,407 04	$592 96
Appropriation, 1917-19, miscellaneous	1,608 96	1,327 00	281 96
Miscellaneous	25,000 00	4,579 15	20,420 85
X-Ray, Meriden and Norwich	3,500 00		3,500 00
Total equipment appropriation			$44,858 96

Disbursements.

Total expended on equipment appropriation	$20,063 19
Balance, cash on hand	24,513 81
Reverted to State Treasurer's office	281 96
Total	$44,858 96

SALARIES AND EXPENSES OF COMMISSIONERS, SECRETARY AND COMMISSION OFFICE.

Receipts.

Comptroller's reserve for Commissioners' salaries	$15,000 00	
Comptroller's reserve for Commissioners' expenses	3,000 00	
Comptroller's reserve for Secretary's salary	5,000 00	
Comptroller's reserve for Commission office expense	6,000 00	
Total		$29,000 00

Disbursements.

Dr. Stephen J. Maher, salary	$2,500 00	
Dr. Stephen J. Maher, expenses	400 00	
Wallace S. Allis, salary	2,500 00	
Wallace S. Allis, expenses	400 00	
Arthur R. Kimball, salary	2,500 00	
Arthur R. Kimball, expenses	400 00	
George I. Allen, Secretary, salary	2,500 00	
Commission office expenses	2,687 18	
		$13,887 18
Balance on Commissioners' salary appropriation	$7,500 00	
Balance on Commissioners' expense approriation	1,800 00	
Balance on Secretary's salary appropriation	2,500 00	
Balance on Commission office expense appropriation	3,312 82	
		15,112 82
Total		$29,000 00

STATEMENT OF RED CROSS FUND OF 1919.

Receipts.

National Tuberculosis Association, Red Cross Fund	$53,037 02	
Miscellaneous receipts	1,317 22	
Other sources	4,526 02	
		$58,880 26

Disbursements.

Executive salaries	$2,620 82	
Stenographers	448 20	
Clerks	32 84	
Traveling expenses, field secretary	377 22	
Office supplies, stationery, etc.	702 00	
Postage, express, etc.	462 44	
Literature and printed matter	1,756 30	
Conferences and institutes	339 87	
Modern health crusade	2,193 36	
Educational—motion pictures	19 16	
Equipment of dispensaries, sanatoria, etc.	7,963 76	
Maintenance of dispensaries	63 25	
Payment for patients in sanatoria	54 86	
Seal campaign expenses	2,978 87	
Miscellaneous expenses	1,200 28	
Distributed to Local Associations as follows:		
Ansonia	1,445 32	
Beacon Falls	75 00	
Branford	231 30	
Bristol	577 00	
Bridgeport	4,600 00	
Danbury	355 86	
Fairfield	942 75	
Griswold	108 41	
Hamden	168 32	
Hartford	2,725 52	
Litchfield	200 00	
Manchester	600 00	
Meriden	1,980 00	
Middletown	487 03	
Milford	100 00	
New Britain	3,006 25	
New Haven	6,645 84	
New London	980 53	
Norwalk	941 47	
Norwich	422 06	
Seymour	200 00	
Stamford	1,816 91	
Torrington	799 76	
Vernon	278 20	
Wallingford	2,000 00	
Waterbury	4,600 00	
West Haven	502 54	
Winchester	100 00	
Windham	776 96	
		$58,880 26

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